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P

PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE
MEDICAL AND SURGICAL SCIENCES

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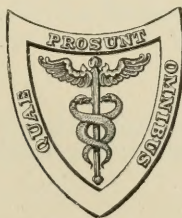
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VOLUME IV. DECEMBER, 1922

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS
AND PERITONEUM—NEPHRITIS—GENITO-URINARY DISEASES—SURGERY
OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES,
DISLOCATIONS AND TUMORS—PRACTICAL THERAPEUTIC
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PROGRESSIVE MEDICINE.

DECEMBER, 1922.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS AND PERITONEUM.

BY MARTIN E. REHFUSS, M.D.

The literature on the subject of gastro-enterology has markedly increased within the last year, making it difficult in a contribution of this size to do justice to the many advances which have been recorded throughout the world. The reviewer finds it difficult to do justice to the large number of contributions which have appeared on a variety of subjects, all more or less allied with the digestive tract. In fact there has been a revival of interest and also a marked increase in the number of contributions which are investigative in character. It is difficult, for instance, and undesirable, to discuss all the contributions on the question of the etiology or the treatment of ulcer of the stomach, unless these contributions have some special point or merit which would recommend them. When possible, the reviewer has personally examined all articles in French, German and English, and has depended on the excellent abstracts of the *Journal of the American Medical Association*, the extracts in the French *Archive des Maladies de l'appareil Digestif*, as well as the excellent summary which the American Institute of Medicine has recently presented. He has, on a number of occasions, investigated these abstracts and satisfied himself that they were accurate and representative.

It is to be noted that the roentgen ray has assumed a point of cardinal importance in all gastro-intestinal investigation, and the number of papers dealing with roentgen-ray diagnosis has been so great that it is manifestly impossible for any well trained internist in this line to ignore them. He thought fit, therefore, to include those papers which were of sufficient importance. It is also noteworthy that there is a renewed interest and also a general feeling that the gastro-enterologist must at least be an internist, and, secondly, a gastro-enterologist. In fact, there are few divisions of medicine which are as intimately linked up with the whole system as is the digestive tract.

Contributions on intestinal infections are constantly appearing.

Bacillus acidophilus has formed the subject of a number of communications with regard to the treatment of various intestinal infections and intestinal stasis.

Fractional analysis and also biliary drainage have both received criticism and approbation, and the time-honored methods of medical investigation of the digestive tract have established themselves more thoroughly and completely. In fact, it is realized that as years go by a tendency is manifested toward the simplification of methods and toward a routine method of examination. This includes, in the best institutions, history, physical examination, roentgen-ray examination, gastric analysis and duodenal analysis, examination of the movement and urine, and whatever specific tests are necessary for the complete exposition of the case. We feel that a study of these pages will amply demonstrate the general trend of modern gastro-enterology.

Interpretation of Digestive Symptomatology. Gaither¹ reviews the question of the symptomatology of gastro-intestinal diseases. Discussing ulcer, he points out the typical history of this condition. On the other hand, stress is laid on the *atypical phenomena* attendant on ulcer. Mention is made of the many factors which might markedly alter the syndrome. The nature of the lesion, its position and extent, the possibility of adhesion formation, pyloritis, perigastritis, and even malignancy alter the clinical course of the disease. Anyone who sees much of ulcer realizes how frequently an atypical course in the symptoms is met with. No mention is made of one of the most frequent associations altering its clinical manifestations, and that is the association with organic disease elsewhere, as well as the associated functional derangements which occur.

Regarding *perforation* and *hemorrhage* it is stated that these occurrences, according to Moynihan and Bolton, are the only signs of acute ulcer. While these symptoms may be the only manifestations of acute ulceration, there are many of us who believe that all chronic ulcers, or at least the majority, begin with acute ulceration which may evolve with nothing but the typically recurring painful indigestion so characteristic of the ulcer type.

Regarding *gall-bladder symptomatology*, again the underlying consideration is the nature and extent of the lesion. Is the lesion limited to gall-bladder walls? Is the lesion adherent to the liver, duodenum, pylorus, hepatic flexure, and the appendix? Is the lesion a simple catarrh, an active spreading inflammation, or even a beginning gangrenous process? The possibility of perforation into the duodenum, and even malignancy, must also be borne in mind. Mention is made of the cardiac symptomatology associated with gall-bladder disease, such as anginoid manifestations and even myocarditis. The reviewer is of the opinion that most of the cardiac manifestations are vagal in origin. Secondary pancreatic involvement from gall-bladder disease, the association of severe infections of the urinary tract secondary to gall-bladder infections, and the possibility of a secondary arthritis or even

¹ Journal of the American Medical Association, October 29, 1921, No. 18, 77, 1407.

secondary endocrine involvement from focal infection, must be borne in mind. The association of appendiceal and gall-bladder disease is common, giving rise to the question as to which is primary. Furthermore, one or both can markedly interfere with gastric function producing bizarre symptomatology. The point is well taken that when these phenomena refuse to yield to medical treatment, the possibility of underlying organic disease is likely.

In the consideration of *appendiceal disease*, it must be recalled that this organ may be attached to the gall-bladder, intestine, ureter, tubes, ovary, rectum or bladder. The associated or reflex gastric changes, and even spasm of the colon with high retention, dilatation and ultimate atony of the cecum, and even colitis must be borne in mind. The writer stresses the value of involuntary muscular spasm as a hint of underlying organic pathology.

Pancreatic conditions are a little bit more obscure, although carcinoma with cachexia is more evident, and, when the head of the pancreas is involved, jaundice may be an early symptom. These cases may be (and here the author quotes Garrod) associated with tremor, dermatographia, Moebius' and Stellwag's signs, and even exophthalmos, which are due to a disturbance of the sympathetic ganglia which lies so near the pancreas. Regarding chronic conditions of the large and small bowel; these organs may be adherent to almost any organ in the abdomen and may present functional, structural reflex changes, spasticity, hypertrophy, atony, dilatation and colitis. Malignancy, syphilis, and tuberculosis must be kept in mind.

Extrinsic factors inducing digestive disturbances are many; pulmonary tuberculosis, failing cardiac decompensation, thyroid and other endocrine disturbances, syphilitic and parasymphilitic affections, reflex conditions from the genito-urinary tract, etc. This paper is helpful and suggests in a general way the attitude to be taken toward the analysis of gastro-intestinal symptoms.

Forman and Roderick review the *clinical interpretation of the Wassermann reaction with special reference to its use in gastro-intestinal cases* in a hospital report. They point out the necessity of knowing how the test is performed and insist on the importance of knowing: (1) The antigens used in the particular test. (2) The temperature and time of the primary incubation. (3) The hemolytic system employed. Blood taken too soon after a meal yields a chylous serum which will give an unsatisfactory result. Alcohol taken before collection has been known to render a known positive serum absolutely negative. Serum containing bile yields a false positive or anticcomplimentary reaction. Furthermore, blood should never be taken after ether or chloroform anesthesia.

The blood should be taken in absolutely clean receptacles and it is recommended that it be taken either by venous puncture or by the vacuum tube. It has been found that extracts of normal organs are better than the extract of the liver of a syphilitic fetus. While the plain alcoholic extract and the acetone insoluble fraction have proved reliable, the cholesterinized antigen is by far the most sensitive.

Regarding the manner of incubation, these observers regard sixteen

to eighteen hours incubation in an ice box at 8 to 10 degrees as preferable to the incubator at 37 degrees. With the cold method, 16 per cent more positives are obtained with known luetic sera.

In every case of suspicious nature where there is a positive suspicion of syphilis and the blood reaction is negative, particularly when the central nervous system is suspected, it is desirable to test the spinal fluid.

While syphilis of the esophagus is rare, nevertheless every lesion of an organic nature should suggest the use of the roentgen ray and a systematic Wassermann reaction. With regard to the stomach, Mills regarded 1 per cent of all organic lesions of the stomach as luetic. Four types of gastric syphilis occur: (1) Simple syphilitic gastritis; (2) syphilitic ulcer; (3) syphilitic gumma and tumor formation; (4) syphilitic stenosis of the pylorus. The typical symptoms of gastric syphilis according to Eusterman are usually a patient in third decade, with marked and progressive gastric disturbances, but with cachexia, a palpable mass (?); anorexia invariably absent, in the presence of a gastric analysis resembling cancer and with more or less characteristic roentgen-ray findings. These are given by Carman as follows:

1. Filling defect.
2. Hour-glass stomach (this is the second most frequent cause of hour-glass stomach—next to ulcer and more frequent than cancer).
3. Six-hour barium retention in only 20 per cent.
4. Gastric capacity diminished.
5. Stiffening of the stomach wall.
6. Absence of peristalsis in the affected area.
7. Pylorus free rather than obstructed.
8. Patient under the cancer age and not ill in proportion to the extent of the lesion shown under the roentgen ray.
9. Absence of niche, accessory pocket, or typical incisura.

In those cases of syphilis in which there are gastric complaints and the cause is not due to the stomach, it may be due to syphilis of adjoining organs, such as the liver, pancreas, lymph nodes; to perigastric adhesions of luetic origin; to reflexes from syphilitic lesions at more distal points in the abdomen; to toxemia with the cachexia of the disease; and to specific lesions of the brain and cord.

Syphilis likewise produces organic lesions of the bowel. Syphilitic ulcers have been described in the duodenum, ileum and colon, and in all these cases a routine Wassermann should be performed. The question of luetic diarrhea is likewise one to be borne in mind.

Syphilis of the colon is said to occur with the same degree of frequency as gastric lues and almost always appears in the distal colon, the pelvic colon or the rectum.

In the discussion of the *acute abdomen*, Forman¹ is of the opinion that in all cases of acute abdomen, the case should be considered surgical until it is proven medical. This rule will result in far less danger than the determination to make a fine diagnosis while the individual may be

¹ Journal of the Medical Society of New Jersey, April 1, 1922, 19, 98.

progressing to a point where the good effects of surgery cannot be realized. In children, especially, the difficulties in diagnosis are apparent, and abdominal pain can occur in the absence of all organic pathology. Furthermore, it may be induced by many conditions which are purely medical. The abdominal pain of pneumonia in children is particularly difficult to distinguish from appendicitis. Acute gastritis is recognized by the history, generalized pain through the upper abdomen, vomiting of mucus and even blood, as well as the diffuse soreness. Acute dilatation of the stomach is recognized by the profuse and persistent vomiting, the upper abdominal distension, and its association with post-operative complications, as well as its occurrence in certain acute infections. Acute intestinal obstruction with rapid and diffuse swelling of the abdomen, absolute constipation and vomiting, is likewise a dangerous condition. Ulcers of the gastro-intestinal tract are all primarily medical, unless complications, such as hemorrhage or perforation as well as organic obstruction, demand surgery. Acute gastro-enteritis is medical, while acute diverticulitis is surgical. The great triad of surgical abdominal conditions (often masquerading under the banner of one another and frequently defying the best attempts at diagnosis) are peptic ulcer, cholecystitis and appendicitis. Gastric tabes must always be borne in mind in the diagnosis of severe abdominal pain, and pyelitis must be remembered as a cause of unexplained fever.

Study on the Value of Various Procedures for the Determination of Occult Blood in the Digestive Tract, Together with Some New Methods. In 1913, Halley discussed the value of the various methods for determining occult blood, and was of the opinion that the Adler (benzidine), Meyer (phenolphthalein), and Weber (guaiac) tests were the most accurate. Pron¹ was of the opinion that the benzidine test was too sensitive, and preferred the Meyer phenolphthalein reaction. Since then, modifications have been suggested which occasioned this paper. The need is not for a test so sensitive that it leads to misleading results. A rough and hardened feces passing over a normal mucous membrane might produce a positive result; and with extremely delicate tests bile pigments, derived from hematin, might, in their normal concentration, induce a positive reaction. Gregersen pointed out, in 1919, that the feces of normal individuals could give a positive reaction with tests which were sensitive to 1 : 3000. Adler, therefore, is of the opinion that a test, to be of value, should have a delicacy below 1 : 500 and 1 : 1000, showing a minimum quantity of 0.10 cg. of blood to 100 grams of feces. This theory, however, has its faults, inasmuch as bleeding is not a continuous process and is imperfectly mixed with the gastric contents or feces which we wish to examine. It is, therefore, frequently desirable to have tests of greater delicacy. Again, outside of the bile pigments, many foods other than meats, and even certain medicaments, according to this author, can give a positive reaction.

In discussing the *technic* employed, emphasis is laid on the necessity of absolute cleanliness; the necessity of examining the center and not the

¹ Archiv des Mal. de l'app. Dig. et de la Nutrition; Paris, 1922, No. 3, 12, 204.

periphery of the stool; the necessity of avoiding not only meats but even insufficiently cooked vegetables and cereals which might, by their passage, induce abrasion of the intestinal walls. Furthermore, every other possible source of hemorrhage, such as the nose, throat, gums and lungs must be ruled out.

The chemical methods are dependent on the principle that an easily oxidizable body, such as guaiac or benzidine, takes on a special color from the oxygen of peroxide of hydrogen through the intermediary of certain oxidases of the blood.

Pyramidon Reaction. This is the test described by Thevenson and Roland. To the liquid suspected add an equal volume of a 5 per cent alcoholic solution of pyramidon, then 6 to 7 drops of acetic acid (33 per cent) and 5 to 6 drops of hydrogen peroxide. The presence of a violet mauve color is an indication of blood. This test is not delicate, and small quantities of blood take a long time to register any color.

The *phenolphthalein reaction* has two serious drawbacks. In the first place it is unstable, and in the second place it is too delicate. In fact, it registers coloration with bile pigment, and, according to Triboulet, there is a pigment intermediate between hemoglobin and the normal bilirubin which registers a reaction.

The reaction of *thymolphthalein* has been placed along with the phenolphthalein reaction. Gregersen says it has the same sensibility as the latter; Küttner and Gutmann claim it is inferior; Boas, on the contrary, claims excellent results with it.

The *aloin reaction*, due to Schaer-Rossel, is performed as follows: To 5 cc of ether acetic extract of feces add 10 drops of peroxide of hydrogen and 30 drops of old oxidized turpentine; then add 10 to 20 drops of a fresh alcoholic solution of aloin, which is yellow in color. An orange cherry-red color is a positive reaction. While it is not influenced by a vegetarian diet, there are many other substances which reduce it.

The *benzidine reaction*, according to most authors, is too delicate; and Halley claims it is not only sensitive to iron, but it gives a reaction with salts of iron, potassium iodide, potassium bromide, sodium bicarbonate, lime water, magnesium sulphate, as well as pus, saliva, muco-purulent expectoration, and even intestinal mucus and, finally, uncooked vegetables with chlorophyl. With dogs, for instance, the ingestion of even less than 0.5 cc of blood produces a positive reaction. Halley found a positive reaction with diluted blood to 1 : 225,000, and Oethinger and Girault to 1 : 250,000. Adler claimed a positive reaction in infant stools even when no gastro-intestinal lesion existed. Pron, however, is of the opinion that if the benzidine be made up fresh with acetic acid, and in dilute rather than concentrated solution, it is of great value.

Gregersen, realizing the defects of the ordinary test with benzidine, attempted to correct them. He found that the sensibility of the benzidine reaction was dependent on its concentration. In 0.5 per cent the reaction is sensitive to 1 : 500, and instead of pure acetic acid he uses one-half strength. Instead of hydrogen peroxide he uses barium peroxide which is more stable. To 5 cc of the acetic acid (50 per cent) he adds 0.025 m. grams of benzidine and 0.10 grams of barium peroxide,

and this mixture is then filtered. Gregersen claims that he judges the quantity of blood from the shade of color, which varies from gray-blue to deep-blue.

Adler tested the sensibility of benzidine with a solution of hydrochloride of hematin. Benzidine at 0.5 per cent shows a sensitiveness of 1 : 100,000, at 10 per cent, 1 : 500,000; then on adding to normal feces a solution of hematin the 50 per cent benzidine gave a sensibility of 1 : 500.

Pron claims the method of Wohlgemuth is, without exception, the simplest and the most practical. The reaction is composed of two solutions:

1. Benzidine, pure	0.50 gm.
50 per cent acetic acid	50 cc.

Prepare cold and preserve in brown bottle.

2. Glucose	5 gm.
Ortizon (Bayer)	2 gm.
50 per cent alcohol	50 cc.

Dissolve the glucose in alcohol, heat gently, after cooling add ortizon and agitate gently; there is always a small amount of residue. In fifteen minutes filter into a brown bottle. On testing, add 1 cc solution No. 1 with 1 cc of solution No. 2. This mixture remains good for several hours. With a pipette apply 1 to 2 drops to fecal smears, but do not mix. Depending on the blood content, a more or less blue color appears. The guaiac test is not supposed to be delicate enough.

The method of Küttner and Gutman of employing a complicated acetone, acetic acid, sodium chloride solution and guaiac is too complicated for clinical routine.

Koopman regards the chloral-alcohol-guaiac procedure of Boas as the method of choice. Boas replaces the ether by alcohol and proposes the following reagent: To 2 cc of a 70 per cent alcoholic solution of chloral, 10 drops of acetic acid are added. Mix in a porcelain dish and let stand for five minutes, then add a pinch of pulverized guaiac and 20 drops of hydrogen peroxide, or a pinch of barium peroxide; add to fecal smears.

Other procedures have been recommended: The guaiacol water of Levy, necessitating several hours in preparation; the long and delicate determination of iron in the stool, the paraphenylenediamine of Boas, the solution of which does not keep; and finally, the leucomalachite; the rhodamine B (Fuld); or the fluorescein reaction which is sensible to the millionth part, and gives a positive reaction with most organic liquids both normal and pathologic are methods which have been suggested.

The *microscopic determination of hemin crystals* is specific but not delicate. It requires 20 cc of blood, ingested, to give a constant positive reaction, and with 10 cc three negatives out of five were obtained (Halley). Finally, the spectroscope offers characteristic bands for hematin.

The author comes to the conclusion that in ordinary practice only

the chemical methods are practical. He believes the phenolphthalein and guaiac tests should be rejected, as well as the original benzidine reaction of Adler, and also the pyramidon reaction. The Boas chloral-alcohol-guaiac is the best, and the modified benzidine merits equal confidence.

The microscopic demonstration of Teichmann crystals lacks delicacy but is specific; and finally, from the standpoint of specificity and sensibility, the spectroscopic method of Shaffer (hemochromogen) is the one giving the greatest guarantee. This paper is discussed in detail because the determination of occult blood is one of the most important in the armamentarium of the gastro-enterologist, and up until recently one of the most unsatisfactory. These abstracts should help considerably to clear the problem.

The Influence of Pituitary Extract on the Gastro-intestinal Tract and Blood. Gorke and Deloch¹ studied the effect of pituitary extracts on the gastro-intestinal secretions of human subjects, and for that purpose they used pituglandol, physotmon and coluitrin. These three new preparations gave practically the same result. On the saliva with 6 patients, there was a decrease in 3 cases, no change in 2 and an increase in 1 case. In the study on the gastric secretion, an injection of 1 cc of the extract of the posterior lobe of the hypophysis was made. Fourteen examinations of the stomach with the stomach-tube were made forty-five minutes after the ingestion of a test-breakfast. The injections of the extract were made ten minutes after the taking of the meal. The results show an increase in the total volume, a relative decrease in free hydrochloric acid and pepsin, but with an absolute increase in both free and total acidity in 8 cases. In 2 cases the total volume was decreased, and the relative values of acid and pepsin increased. No effect was observed in 3 cases. Roentgen-ray study showed increased "pyloric tonus" and increased "peristole" function. The duodenal tube remained two hours in the stomach instead of the usual normal rate of one-half an hour.

Vagus stimulation, with increased tonus and increased secretion, is more frequent. The duodenal secretions were studied with the tube and the contents examined for trypsin, diastase, bile pigments, and the cholesterol content. In 9 cases there was a reduction in the quantity of the secretion, with an increase of ferment and cholesterol. Three cases showed an increase of secretion and ferments. In this group, 9 cases correspond to stimulation of the sympathetic and 3 to stimulation of the vagus. Many cases showed increased intestinal peristalsis and colicky pains in the abdomen, and 3 showed profuse diarrhea.

It will be noted that the action on the stomach was predominately vagal, and on the duodenum predominately sympathetic.

Visceroptosis. NORMAL INCIDENCE. Bryant² in a preliminary communication, discusses the very important subject of the incidence of ptosis of the viscera. Burekhardt, writing in 1912, had no difficulty in collecting some 600 titles on the subject of ptosis, but, as Bryant points

¹ Archiv. f. Verdamingk., February, 1922, **29**, 149.

² Journal of the American Medical Association, October 29, 1921, p. 1400.

out, few are of a substantial scientific nature. Smith's study of cecal position in 1050 infants, and the investigation of Alba, in 1909, on some 1870 males and 1620 females, studied from a clinical point of view, are probable the most valuable.

Bryant's studies were based on the total of 290 postmortem cases of all ages and both sexes. In a general way, the following are the results: Some degree of visceroptosis was present in 48 per cent of all cases examined; about 8 per cent more than half the males, and 8 per cent less than half the females being normal. An examination of the male cases showed that one or more viscera presented an extreme degree of ptosis in 10.1 per cent, the fetal group; in 12.4 per cent of the group below forty years of age; in 8.2 per cent of the group above forty years of age, and in 10.4 per cent of the senile group. There is therefore no evidence to indicate that visceroptosis is a progressive disease in the male.

An examination of the female group shows that one or more viscera presented an extreme degree of ptosis in 17.1 per cent, the fetal group; in 20 per cent of the group below forty years of age; in 19.4 per cent of the group above forty years of age; and in 23.6 per cent of the senile group, visceroptosis was extreme. There is, therefore, some slight evidence to indicate that visceroptosis is possibly a progressive condition in the female.

Regarding the individual viscera, however, the evidence is more conclusive. In both sexes there is no evidence of visceroptosis in the fetus with regard to the liver, right or left kidney, stomach or pylorus. On the other hand, the ileocecal valve, the ascending colon, the hepatic flexure, the splenic flexure, the descending colon and the sigmoid flexure all show evidence of low or loose attachments in the fetus of both sexes; the ptotic condition being most marked in the male at the ascending colon with 25 per cent of extreme loose attachment already present, and in the female at the hepatic flexure with 53.3 per cent of extreme ptosis already present. Throughout life the percentage of extreme variations from normal is, with few exceptions, greater at every point examined in the female than in the male. Thus in the case of the ileocecal valve; extreme ptosis in males below forty was 13.6 per cent, in females of the same group it was 34.5 per cent. In males above forty, 10.9 per cent of cases examined revealed this condition, while the female group revealed an incidence of 44.4 per cent. In old age this incidence becomes even more marked, so that 50 per cent of the senile female group demonstrate it, while the male senile group reveal it in 17.6 per cent.

Many of the generalized statements which occur in the literature are certainly open to criticism. For instance, the idea that there is a necessary connection between ptosis of the right kidney and ptosis of the hepatic flexure, ascending colon and cecum. Bryant, however, believes that if there is any relation between the kidneys and the flexures of the colon, it is an inverse one, since ptosis of the hepatic and splenic flexures tend to decrease with age in both sexes, while ptosis of both kidneys very definitely tends to increase with increasing age in both sexes.

No. of Ulcer.	Viscera.	Per cent of frequency.		Ptosis. Extreme.
		Absent.	Present.	
58	Liver	32.8	46.6	20.7
162	Right kidney	55.6	35.2	9.3
35	Left kidney	51.4	42.9	5.7
277	Stomach	46.9	46.9	6.2
81	Pylorus	53.1	28.4	18.5
282	l. c. valve and cecum	39.7	37.6	22.7
208	Ascending colon	47.6	28.4	24.0
251	Hepatic flexure	38.3	41.0	20.7
219	Splenic flexure	75.3	17.5	7.3
197	Descending colon	67.5	24.9	7.6
196	Sigmoid flexure	59.7	32.1	8.2
	Average	52.0	34.1	13.9
Total males, 177.				
Total females, 113.				
Total cases, 290.				
Total observations, 1966.				

Therefore, it is evident that visceroptosis affecting the liver, right and left kidney, stomach and pylorus, is acquired. Visceroptosis affecting the large bowel in both sexes is largely congenital or developmental.

It is interesting to note in the discussion of this study that Morrison, of Boston, who based his observations on fluoroscopic examination, found the stomach in only 18 per cent to be 1 or 2 inches above the crest of the ilium; 45 per cent were at the crest or 1 inch below, and 38 per cent were low in the true pelvis. He considers a line between the iliac crests as a normal boundary line. In 30 per cent of his 1500 cases, he found cecum anywhere from 2 inches below the iliac crest, and in the pelvis and even on the left side. This is the experience of the reviewer. Morrison found 40 per cent of his cases showed incomplete ileocecal valves.

From these remarks, it is evident that Bryant's material was post-mortem material, examined under conditions which have little or no counterpart in our clinical investigations. The postmortem subject is prone and his organs have lost their resiliency, a very different situation from the individual examined in the upright position back of the screen. Nevertheless, these studies are of great value as indicating the "absolute incidence of ptosis. The reviewer has seen many an empty stomach which only assumed the position of ptosis after it was filled with the opaque mixture.

A number of contributions have been made to the ptosis problem, but the important feature seems to be the fact that function, rather than form, dominates the problem. One does not infer from this that form cannot dominate function; in fact, this would be far from the truth, but the impression seems to be gaining ground that only when this misplaced organ fails to functionate correctly do symptoms supervene.

Coffey¹ discusses the phases of the situation which impress him. For instance, in the study of the evolution of the human species, it is noticed that among quadrupeds the gastro-intestinal tract is suspended by peritoneal supports, in the form of definite and free mesenteries. In the erect posture, man has had provided for support of some of the

¹ Journal-Lancet, March 15, 1922, 42, 133.

heavy organs of the abdomen by peritoneal fusion. In a large number of the race this fusion has either failed to take place, or does so in rudimentary fashion, with the result that these defective individuals are potential ptotics. The characteristic pear-shaped abdomen is so arranged that the psoas muscles on either side form a shelf where most of the heavy organs rest, assisted by the fusions which have taken place. In the absence of these fusions, compensatory postural changes tend to obliterate the shelves and alter the entire body formation. Furthermore, the walls of the abdomen are strong and relatively inelastic, tending to hold the organs in proper position and at the same time produce more or less constant intra-abdominal pressure, which goes far to holding the organs in proper position. Anything which weakens this wall lessens support, and a lessening of intra-abdominal and mesenteric fat acts in the same manner. In fact, the intra-abdominal pressure is regulated not only by the tension of the walls, but also by the quantity of fat, as well as the gas and gastro-intestinal contents. Reduction of fats tends to decrease intra-abdominal pressure, and Nature, in order to restore equilibrium, tends to produce gas and conserve liquids in the gastro-intestinal tract, thereby inducing dilatation and gradual atrophy of the muscular walls. Medical treatment, according to this author, consists of hypernutrition and fattening of the patient (preferably while at rest in bed) bowel regulation, and, finally, postural exercises such as those recommended by Goldthwait, Franklin, Martin, and others. These patients must be impressed with the necessity of keeping up these precautions for many months.

Poos¹ discusses the subject of visceroptosis. Among the symptoms given are flatulence, constipation, cardiac palpitation (particularly after meals), heartburn, pain in the abdomen and back, varying degrees of melancholia, headache, lack of energy, sleepiness through the day and insomnia at night, inability to think, concentrate or remember, coldness of the extremities and frequency of micturition.

These are all signs of nerve exhaustion and autonomic imbalance, and in the opinion of the reviewer can scarcely be held as specific to ptosis, although they do occur with undue frequency in this affection. Poos recommends the general measures which we usually employ in this condition—removal of obvious causes; toning up the viscera and nerves, for constipation, diet rich in carbohydrates; iron for anemia; sedatives for nervousness, and psychotherapy. Rest and relaxation are indicated, and the sinusoidal current applied to the back, below the angle of the scapulas, is advised.

Parker² discusses the question of support and postural exercises, and emphasizes the necessity of wearing a belt or support through the waking hours, and also points out the value of exercises in bed, which enable the organs to assume their normal position. The exercises of greatest value are, naturally, those in which the body is flexed on the pelvis.

Einhorn³ discusses the *recognition and treatment of minor ailments of the digestive tract*.

¹ Illinois Medical Journal, April, 1922, **41**, 254.

² Australian Medical Journal, March 4, 1922, **1**, 237.

³ New York Medical Journal, June 7, 1922, p. 681.

Briefly, these ailments might be mentioned somewhat as follows:

Acute gastritis; there is anorexia, retching, sometimes vomiting and the feeling of fullness and pressure over the stomach.

Acute duodenal catarrh shows sensitiveness in the upper right quadrant of the abdomen and frequently jaundice.

Acute cholecystitis, tenderness over the region of the liver and bowel.

Acute hepatitis shows likewise some enlargement of the liver, but this is more definite and tenderness is more pronounced.

Acute enteritis, cramps throughout the abdomen with nausea and frequent diarrhea and tenderness to pressure in the lower abdomen.

Acute colitis, tenderness over the large bowel, cramps, constipation, movements with mucus and often blood.

Acute appendicitis, pain, tenderness and rigidity in the right iliac fossa (McBurney's point).

In all of these conditions, a rise of temperature may be present. Mention is made as to the method of treatment in these cases, but the general inference is that these cases should be given rest and an abstemious dietary.

The chronic minor ailments of the digestive tract include hyperacidity, subacidity, nervous indigestion, nervous regurgitation, nervous eructations, anorexia, sitophobia, chronic constipation.

Conditions which go on for a long time with a train of symptoms which do not change in gravity, usually belong to functional disturbances. Conditions showing changes in the subjective symptoms but persisting for a long time without materially deteriorating the objective state of the organs are generally neurosis. Diseases lasting only a few months, but becoming steadily progressive and altering the appearance of the individual from that of health to obvious disease, are usually those of organic type and often malignant. Digestive disturbances persisting for some times, alternating with periods of freedom from symptoms and often reappearing in steadily severer form, are often due to benign organic diseases. In this short paper the author discusses in a general way the commonly accepted methods of treatment in these conditions.

The *roentgen-ray investigation of the digestive tract* is now a recognized procedure which is indispensable to any thorough investigation of diseases of this system. In fact, every well-trained gastro-enterologist realizes the necessity for a thorough roentgen-ray study of the gastro-intestinal system. The instruments which are now obtainable are of such a character as to permit of exact work, although the period of apprenticeship is one which is somewhat arduous. One cannot conscientiously take up this line of work without thorough ground-work and study, and yet it can be safely said that the fundamental principles of gastro-intestinal roentgenology have now been laid down. Many of the questions which troubled observers in past years, such as the position and form of various organs and the interpretation of shadows, have now been pretty thoroughly cleared up.

The history of gastro-intestinal roentgenography is redolent with changes in procedure and also changes in our conception regarding the interpretation of certain images which were presented in this work.

Today it has been conceded that the correct technic for gastro-intestinal work is a fluoroscopic examination of the organs under the screen together with a registration of the image, either serially or singly, by the conventional film or plate methods.

Holland¹ discusses the question of the fluoroscope in diseases of the abdominal organs. He recognizes the fact that both the roentgen-ray plate and fluoroscope have their limitations, but is of the opinion that the ideal arrangement provides for the use of both methods. In a general way, an interesting summary of these methods is given.

For the internist, for instance, the fluoroscope is certainly an extremely valuable adjunct to other clinical methods. For the trained fluoroscopist, the method is one which cannot be duplicated. The observer must remain in a dark room for at least ten minutes until his eyes are thoroughly accommodated. Mention is made of the fact that confinement in a poorly ventilated space, as well as severe eye strain, are responsible for the headache and often the fatigue which the fluoroscopist experiences.

In the examination of the stomach one must make certain of examining the stomach in every position and also carrying on palpation of the stomach under the roentgen-ray screen. The hands are properly protected by lead gloves, so that the organ can be deeply palpated in every position. In diseases of the duodenum, the fluoroscope is almost an instrument of precision. Beyond this point the condition of the small bowel cannot be so readily investigated unless there is adhesion formation or obstruction to the small intestine. The barium enema is by all means the most satisfactory means of investigating diseases of the large intestine.

It is interesting to note that, in Holland's fluoroscopic examinations, there was a record of 90 per cent correct diagnosis. The value of fluoroscopic examination is one which is largely due to the experience of the observer, and every gastro-enterologist ought to be encouraged either to have his patients fluoroscoped or to actually perform the examination himself. With the modern Coolidge tube and the simplification of apparatus at the present day, the technical difficulties are very considerably lessened. It is therefore of interest to review some of the contributions regarding roentgen-ray studies on the digestive tract.

Charpy² discusses a form of *barium cake* which is agreeable flavored. The patient is allowed to ingest a sufficient number, two or three of which usually give a satisfactory image, while five or six taken with a cup of tea permit the examination of the intestinal tract. These cakes are considered superior to the usual barium soups and gruels.

Several interesting studies were made regarding gastric function. In one of these, Nielsen,³ investigated the motility of the stomach during rest and during movement. He examined, for instance, 20 syphilitic patients who never had any evidence of gastric disease and gave them the regular rice-gruel, barium sulphate mixture containing 100 grains

¹ New York Medical Record, June 7, 1922, 115, 659.

² Bull. et mem. soc. de radiol. med. de France, Paris, April, 1922, 10, 98.

³ Ugeskr. f. Læger, Copenhagen, April 6, 1922, 84, 328.

of barium sulphate. This author found that the stomach emptied more rapidly during movement than during rest. He also pointed out the fact that in women the stomach empties somewhat more slowly than men during rest as well as during movement.

Lasch¹ made a study of the *effect of atropine on gastric motility*. His method was as follows: He first roentgen-rayed the stomach to determine peristalsis, the condition of the pylorus and the gastric evacuation-time. Two or three days later he observed the same condition again on the screen, and then injected atropine intravenously while the patient was being fluoroscoped in order to be able to judge the effect from the very beginning. He observed different effects on different days in the same individual. For instance, the evacuation-time was increased, and this was most pronounced in the hypertonic and hyperperistaltic stomach. The tone of the stomach was distinctly decreased in cases of hypertonus. In studying the question of pain, nothing definite could be demonstrated. Apparently, true spasm was not influenced by atropine, and the influence on the pylorus was greater when atony existed. Fugitive stimulation was noted in several instances, but, in general, it might be stated that the delay in the emptying of the stomach after atropine was the result of a decrease in tone and peristalsis rather than an actual increase in the tone of the sphincter.

Schmidt² discusses the question of *serration of the greater curvature of the stomach in the roentgen-ray picture*. Mention is made of the significance of this portion of the greater curvature. Groedel, in his book, interprets the serrations of the left lateral contour of the stomach as an arrhythmic and a superficial wavelike movement but does not define its significance. Schutz regarded it as a new symptom of ulcer, and discusses serration as a crenated appearance of the lateral border, with notches of varying size and depth. Stoccarda studied the anatomical specimens of the stomach particularly with reference to the folds of the mucous membrane and came to the conclusion that serration is not a sign of ulcer of the stomach. The present author examined 351 surgical cases, 262 of which were cleared up by laparotomy. The roentgen ray with the barium meal was made, including both fluoroscopic and the making of plates. Thirty-two of the stomachs were even examined after operation. Of the 351 cases serration was found in 114, and on fluoroscopic examination in 68, on the plate in 62, in both ways in only 16. Ninety-nine serrated stomachs were operated upon for ulcer of the stomach. The diagnosis was confirmed in 93 out of 101 cases of ulcer. Of these, 45 showed serration, on the plate in 31 cases, on the screen in 22, in both 5. In these positive cases the ulcer was on the lesser curvature in 31 cases, in the antrum or near the pylorus in 14 cases, and 11 cases showed spastic hour-glass stomachs. The serration first appeared when the stomach began to empty, was rarely ever seen on the lesser curvature and seemed to be unaffected in any way by the position of the ulcer. With ulcer of the duodenum, serration was very similar to that of ulcer of the stomach and had nothing to do with peristalsis. Serration, however, is much rarer in

¹ Med. klin. Wehnsehr., April 22, 1922, **1**, 840.

² Arch. f. klin. Chir., March 8, 1922, **119**, 225.

malignancy than in benign ulcers. In 9 out of 26 cases of gall stones, confirmed by operation, 9 showed serration. In 43 cases of hernia and adhesive processes in the abdomen, 33 of which were confirmed by operation, serration was found in 17 and was in no way different from that found in ulcer of the stomach. In 44 cases of ptosis and atony, 21 of which were operated on, serration was demonstrated in 5. Finally, in 37 cases where there was no sign of stomach disease but in which operation was performed for other causes, there were 8 cases, and in 4 of these serration had been seen.

The author, therefore, believes with Schutze that serration is simply a sign of increased tonus and that it cannot be regarded as a sign of any certain gastric disease, but rather as a manifestation of a general increase in tone.

In the consideration of *roentgen-ray examination of the gastro-intestinal tract*, Hartung¹ discusses the essential features of roentgen-ray examination, and favors fluoroscopy as a routine procedure—with the recording of important features by plates. The well-known pictures are mentioned: Sacculation of the esophageal contour in diverticulum; the stoppage of food in cardiospasm with its characteristic deformity; six-hour retention with exaggerated peristalsis he considers an organic lesion (a rule which is in keeping with our best knowledge at the present time); the niche of chronic ulcer; the filling defect of gastric cancer—are precisely what we are looking for in every case. The author's statement that acute superficial erosions may show no roentgen-ray evidence is again in keeping with our knowledge of the subject. Cholelithiasis and cholecystitis are difficult at times of demonstration. Pancreatic lesions may be demonstrated by changes in the position, or obstruction of the duodenum, or a pressure defect in the gastric image. Lane's kink and ileal stasis may be demonstrated. Finally, stasis of the colon should only be ascribed to ptosis or functional defects when all organic lesions have been ruled out. Anomalies and inversions, as well as hernias, can be shown by the roentgen ray.

Barjou² discusses the question of *roentgen-ray examination of the esophagus*. In his opinion, esophagoscopy and roentgen-ray examination should supplement one another. He discusses the mechanism of roentgen-ray examination and suggests that the organ be examined by liquid, opaque and pasty material, and even capsules containing bismuth. The finding of compression, foreign bodies, stenosis, diverticulum, spasm or atony may all be made in this way.

True megaesophagus is caused by some congenital malformation; or spasm, atony or inflammation. Atony is best shown by the swallowing of the bismuth capsule, which descends in stages like descending a staircase.

Diagnosis and Treatment of Esophageal Diverticuli. Bensaude, Gregoire and Grenaux³ discuss the high, or pharyngeal diverticuli. Pharyngo-esophageal diverticuli are always located in the posterior

¹ Illinois Medical Journal, April, 1922, No. 41, p. 258.

² Lyon Med., March 10, 1922, **131**, 187.

³ Arch. d. mal. de l. app. digest., Paris, May and June, 1922, No. 3, **12**, 145.

wall of the lower pharynx just above the entrance of the esophagus. In the beginning the patient may have some difficulty in swallowing, but the condition develops symptoms producing obstruction, dysphagia, pain, regurgitation especially when the body is inclined forward, congested face, cervical tumefaction, gurgling, fetid breath owing to the fermentation of the contents of the sac, and compression symptoms, such as dyspnea, neuralgia and changes in the voice. Tumefaction in the neck can sometimes be emptied by pressure, but the roentgen-ray examination is the imperative one which may be supplemented by the use of a sound or catheter. The use of a guiding sound, using silk thread which is swallowed, and guiding the sound along the throat merits much wider usage. The authors recommend Bruning's esophagoscope. According to these authors, the roentgen-ray evidence is much better than that obtained by a sound or a catheter and is rather characteristic. The Bruning instrument is introduced into the obturator of a Sippy apparatus with the patient in the sitting position. It should be possible to see both the openings of the diverticulum and also of the esophagus, and these can be examined in detail. Medical treatment is never satisfactory, although it is often demanded. It seeks to keep the pouch empty and to overcome stenosis.

The patient may take small quantities of food into his mouth and swallow completely before taking more, or may use various maneuvers, such as sitting in a certain position, or applying external pressure to the throat while swallowing. The sound may be used to wash out the sac and, again, on certain occasions the sound may be used for feeding purposes.

Operation can be done in one or two stages, although the complete removal of the diverticulum in the first stage is preferable. The reported mortality of 16.6 per cent is due to the fact that cases have been included which date back to the preantiseptic era.

An account is given of the operation for this condition and the technic described which is used for the removal of the diverticulum. Liquid feeding is commenced on the third or fourth day. During the first few days the patient may be fed by an enemata and a solution of glucose. This paper is illustrated, and shows the operative technic and method of study, and describes three cases in detail.

Cancer of the Esophagus and Radium Treatment. Hanford¹ discusses the question of the treatment of cancer of the esophagus by means of radium. This author points out the fact that it is difficult to determine the dosage and length of exposure of radium owing to the difficulty in exactly determining the extent of a carcinomatous growth in the esophagus. From the few autopsies which he was able to view, he was safe in assuming that the diseased area was from one to two inches in extent. He points out the fact that the dose of radium must be sufficient to produce a killing action on the diseased cells and not a stimulating one.

Mills and Kimbrough mention five requisites for the proper placement of radium in the esophagus: (1) A knowledge of the location and

¹ Journal of the American Medical Association, January 7, 1922, No. 1, 78, 10.

physical peculiarities of the tumor and the resulting stricture, especially as to the location, extent and direction of stenosis; (2) a form of effective and non-traumatizing canalization of the cancerous stricture; (3) a mechanical means of maintaining the radium in direct contact with the tumor; (4) a ready means of frequent observation as to the position of the radium during the period of treatment, and (5) a careful selection as to its filtration and frequency of treatment, guided by such experience as we have and the individual particulars of the case.

There are three methods commonly employed to locate the position of esophageal cancer: (a) Fluoroscope; (b) with esophageal sounds, and (c) by esophagoscopy. In some instances it is necessary to use all three methods, although this author is in favor of omitting the esophagoscope except for obtaining a microscopic specimen. Ordinarily this author obtains a plate of the lesion and this picture is used for subsequent reference in the treatment of the case. The patient is then placed back of the fluoroscope and an olivary body on the end of a spiral wire is introduced into the canal. When the olivary body comes in contact with the stricture, the position of the spiral wire at the point where it passes the incisors is marked with a piece of adhesive, and the wire is removed and measured from this point to the tip of the olivary body. This method gives a definite distance to work on, when the radium carrier is sent down. If stenosis is not extreme and will admit of a fairly large-sized olivary body, very little dilatation of the stricture is required. This open canal, however, does not exist in the majority of patients seeking treatment, as the patient usually waits until swallowing is painful in the extreme, and the fluoroscope will show only a small trickle of bismuth through the stricture. In these cases of extreme stenosis, he has had more success with a device popularized by Sippy, which will enter a stricture through which water will trickle. The device is made of piano wire about 3 feet long. On the end of this wire is soldered a small cone $\frac{1}{4}$ inch long and $\frac{1}{8}$ inch in diameter. From the tip end of this cone to the shoulder is a hole for the passage of silk thread. A spiral wire tube fits over the piano wire, but cannot pass over the end because of the cone. On one end of this spiral wire tube is a screw that will fit into a series of olivary bodies. The device is used thus:

"The patient swallows a silk thread (silk twist, letter D). This is accomplished by incorporating about a foot of thread in a 5-grain capsule or a piece of soft candy. Twenty-four hours is usually sufficient time for the thread to pass through the stricture into the stomach and become anchored in the intestine. The mouth end of the thread is then threaded through the hole in the cone at the end of the piano wire, and drawn taut. The piano wire is then passed gently down the string and worked through the stricture. As a rule, this is easily accomplished. At this stage, the smallest olivary body is screwed onto the spiral wire tube and passed over the piano wire, down through the stricture. When this is done the next larger olivary body is threaded over the piano wire, until three or four have been threaded on the wire, each one a size larger than the one preceding. The small ends of the olivary bodies are pointed

down. At this time, three or four olivary bodies, beginning with one about the size of the last one threaded on the wire, are slid down the wire with their bases pointed down. The second series diminish in size, thereby making the greatest circumference in the middle of the complete set of olivary bodies. When these have all been passed through the stricture, the piano wire is removed, together with the olivary bodies. This dilator is very satisfactory as there is no danger of trauma, if it is manipulated properly. Even after the dilatation, patients will say they feel much better; but, of course, this is only temporary.

"The maintaining of the radium in contact with the tumor is accomplished in various ways by different operators. He prefers the apparatus shown in the illustration. By its use, the patient is not troubled with the applicator and is barely conscious of its presence in the canal. After the applicator has been in position the required number of hours, it is easily removed by means of the attached strings. When the lesion is

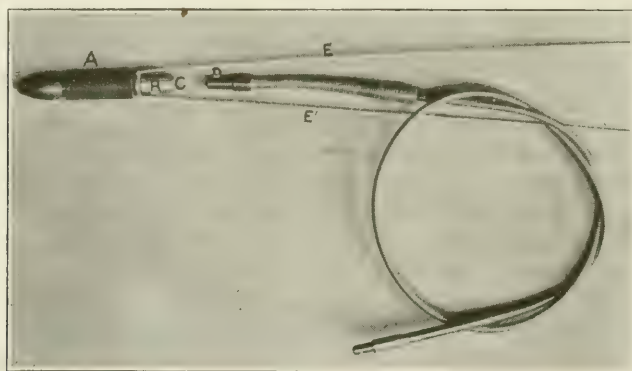


FIG. 1.—A, radium carrier. The radium is in the barrel of this tube; B is a screw cap with a depression in the top (C) to accept loosely the tip of the spiral wire (D); E and E' are double strings of heavy linen thread. (Hanford.)

at the lower end of the esophagus, care must be taken that the carrier does not work down into the stomach. If this occurs, it can, of course, be removed, but only with considerable force, and injury of the walls may result. The objection to wires as the means of retaining the radium carrier in position is that much discomfort is caused the patient, and the patient cannot retain the radium as long as is desired. By using the radium carrier the author has described, it is necessary only to verify the position of the carrier once with the fluoroscope.

"After the radium carrier is in position, a roentgenogram is taken which will show clearly the position of the carrier. Six hours after the carrier has been placed, the patient should be placed behind the fluoroscope and given a small amount of fluid bismuth. Observations are then taken to determine if the carrier is still in the right position.

"This requisite deals with dosage, screening, etc. His dose in treating cancer of the esophagus is based on empiricism. Without doubt,

our dose would be different in many cases if the diseased esophagus was laid flat before us, for we would then know the thickness of the diseased area. We are compelled to select a dose that we have found will do certain things to tissue that has been under our sight. Therefore, the author has selected 50 mg. as the dose, and the time of exposure to each position from eight to ten hours. If we wish to irradiate 3 inches of the canal, we should start at the lower position, and at the end of eight hours we should pull the string up 1 inch, and at the end of another eight hours, we should pull it up another inch and so on. He always hopes that he has gone deep enough into the surrounding diseased tissue, but not too deep."

In the author's series of 15 cases, he points to 4 cases which seem as if they were cures, but in all these cases there was benefit from the first series of treatment. In fact, the dysphagia is relieved in almost every instance, and therefore it might be said definitely that the majority of patients are either benefited or their life is prolonged. Furthermore, it is pointed out that by means of dilatation and the proper application of radium, gastrostomy is avoided. It is a significant fact that many observers in this line believe there is a real future in the use of radium in this condition.

Heller¹ points out the *accessory uses of the duodenal tube*. He mentions the many uses of the ordinary gastro-intestinal tube such as the reviewer has described. In the first place, as a syphon in cases of regurgitant vomiting; in the second place, as an auxiliary common duct in the presence of biliary obstruction due to cancer or impaction of stone in the ampulla. He also speaks of methods of introducing the stomach tube into stomachs of unwilling or comatose patients, one method being by threading the tube over a piece of piano wire, introducing the tube and then withdrawing the wire. Another one is threaded through an ordinary colon tube. He also mentions outlining the stomach after the introduction of the tube into the stomach. He is in the habit of doing this after the microscopic and mechanical examinations have been made. This article is suggestive of many of the uses of the gastro-duodenal tube.

Lim² discusses the *histology of the gastric mucous membrane*. His conclusions are as follows from studies on the cat:

The gastric mucous membrane is principally formed by relatively small tubular glands which become more complex near the orifices of the viscus, especially near the pylorus the glands are lined by one or more kinds of cells of which the following types may be recognized:

1. Surface mucus secreting cells, which include the cells lining the surface and the gland ducts which lead from it.

2. Mucoïd cells, of which there are two closely allied groups; (a) the cardiac and pyloric cells which form the sole lining of the glands within about 0.2 mm. and 15 mm. of the esophageal orifices respectively; (b) the mucoïd cells proper which occur in the large intervening region

¹ Therapeutic Gazette, July 15, 1922, No. 7, 38, 461.

² Quarterly Journal of Microscopical Science, June, 1922, 66, P. 2, 187.

(fundus) where they are intermingled with the peptic and oxyntic cells; they generally occupy the superficial or upper part of the gland-tube.

3. Peptic cells, which are found often in conjunction with mucoid cells within the deep part of the gland; but formerly both peptic and mucoid cells were described as chief or central cells.

4. Oxyntic cells, which chiefly occupy the upper portion of the gland, where they are found between mucoid cells; in the deeper portion of the gland they take up a parietal position.

The interglandular tissue contains basophil connective-tissue cells, oxyphil leukocytes, and a few cells with large eosinophilic granules.

The Influence of Cerebral Activity on the Secretion of the Gastric Juice in Man. Schrottenbach¹ describes the result of an interesting series of experiments carried out on two patients under presumably very exact conditions. These patients were a girl aged five years, and a man aged fifty-nine years, in whom a gastric fistula was made to relieve a complete stricture of the esophagus. On these two patients a series of experiments were carried out, with the idea of studying the effect of various forms of cerebral activity on the gastric secretion. In other words, most of these experiments, psychic in nature, are in a way similar to experiments performed both on animals and on man. In fact, within recent years, both in England, Germany and on this side of the water, renewed attention has been paid to the so-called psychic secretion. This author carried out a series of experiments which might be classified as follows:

According to the nature of the stimuli; physiologic stimuli, those for instance which are associated with contact with the mucous membrane of the mouth; optic stimuli; which are due to the sight of food; acoustic stimuli, or what is known as acoustic associated stimuli, the idea being that the stimulus to the ears will be one which will effect the gastric secretion; disagreeable as well as pleasurable emotions; the effect of sleep or sleepiness; and, finally, of tension.

In a few words, the results might be summarized as follows: The gastric secretion is increased by the chewing of food, by the suggestion of food even through so-called optic association or through auditory association; also by a feeling of hunger and even by pleasurable emotions which may not necessarily arouse the appetite. This author noted, for instance, that there was less secretion after optic suggestion than from physiologic chewing of food, but not infrequently the chewing stimuli were equalled or even surpassed by the so-called acoustic associated phenomena.

On the other hand, the secretion is decreased by disagreeable emotions. The author also mentions the fact that stimuli, for instance, which increased the secretion may be lessened or even destroyed by a temporary disagreeable emotion or even by the action of sleep. In other words, obviously, all these emotions have a great deal to do with the character and the amount of gastric secretion which is poured into the stomach,

¹ Zeitschr. f. d. ges. Neurol. u. Psychiat., July 30, 1921, 69, 24.

and, furthermore, there is no question but that disagreeable emotions and exhaustion can cause a marked reduction in the gastric secretory output.

In this series of studies, an exact estimation was made of the so-called latent period between the moment of stimulation and the appearance of secretion. It will be recalled in the experiments which Pavlov and others carried out that the latent period was occasionally as high as five minutes between the period of stimulation and the period for the appearance of the secretion. This author, however, found that the highest period was one hundred and eighteen seconds which is less than two minutes, while in many instances the latent period was distinctly less than one minute. For instance, it was interesting to note that the reception and conduction of optic and acoustic stimuli is much more rapid than the gustatory and olfactory stimuli.

Gastric Symptoms. An Analysis of 1000 Cases. Blackford¹; this article is a résumé of a study of 1000 cases in which the gastric symptoms were such as to necessitate a gastric examination. In 25 per cent there was no recognizable organic pathologic condition; in 6 per cent he was unable to classify the condition; in 2 per cent the complaints followed operation; in 35 per cent the intra-abdominal condition was other than gastric; in 18 per cent the underlying condition was systemic; and in only 14 per cent was definite gastric disease found. In a total of 141 gastric lesions the distribution was as follows: Carcinoma, 38; sarcoma, 1; gastric ulcer, 16; duodenal ulcer, 83; duodenal diverticulum, 1; gastric syphilis, 1; hair ball, 1.

In the consideration of extragastric causes, the appendix as a reflex cause was considered only in 78 cases, and the reviewer agrees with the author that it is wise "to be rather slow in the diagnosis of chronic appendicitis as a cause of reflex stomach disorders, unless there is a definite history of acute attacks and no other pathologic condition is suspected. In fact, 130 patients already had their appendices removed, with benefit to only a little over one-half. Cholecystitis, with or without stones, was the diagnosis in 145 patients; constipation is presumably the cause in 71 cases, which, if colitis and other conditions of the large bowel be included, is increased to 98 cases. An interesting point is the fact that in 3 cases large six-hour gastric residues disappeared after symptomatic relief of the intestinal condition. Five individuals with "*amœba histolytica*" came in because of gastric indigestion rather than mild spasmodic diarrhea. Syphilis was the cause in 25 cases; tabes in 5 cases, and migraine was interpreted as the cause in 16 cases. Sprue, epilepsy, Addison's disease, goiter, malaria, cirrhosis and metastatic malignancy were found, but too infrequently to classify.

Owing to the conciseness and value of the report I wish to quote verbatim Blackford's findings regarding "functional" and "postoperative" conditions, as well as his conclusion which must be of interest to every gastro-enterologist.

¹ Journal of the American Medical Association, October 29, 1921, p. 1410.

FUNCTIONAL DISTURBANCES OR CASES WITH NO DEMONSTRABLE PATHOLOGIC CONDITION. Patients come to the physician's office complaining of indigestion more often than of any other complaint, yet in 25 per cent of all such cases we have been unable to demonstrate, or even seriously to suspect, organic disease accounting for the stomach complaint. The neurologist may often attach a name to the disease, and the materialist may say that neurasthenia is as much an organic disease as carcinoma; yet at present we cannot demonstrate the pathology and so must class it under malfunction. More knowledge may make this functional group smaller, but it will probably not be from usually attributing the symptoms of a hypersecretion or hyperacidity to the reflex gall-bladder or reflex appendix.

This functional group includes those in whom searching investigation has failed to show organic disease to account for their stomach symptoms. We here place that large number showing poor gastric function attributable to irregular hours, over and under eating, chronic dietary indiscretions, visceroptosis, chronic debility, asthenia, neurasthenia, psychosis, menopause neurosis, etc.

Hyperacidity and hypersecretion, when very marked, are usually of functional origin. The 5 highest acidities in this series were found in patients without discoverable abdominal lesion. The 10 patients showing the highest acidities include only 3 with organic disease.

Persistent achylia is unquestionably often functional, but should be considered so only after ruling out chronic gall-bladder disease, carcinoma and chronic colitis. Good gastric function is dependent on constitutional well-being; hence disturbance of function may be secondary to practically any disease, nervous or organic. The clinician who fails to spend as much time and effort as is necessary in getting the whole story leaves himself without the most valuable of all aids for the correct interpretation of symptoms. Physical examination and laboratory findings are important, but after all they give the final diagnosis in only a small portion of cases.

The asthenic, complaining individual bringing in roentgenograms of the "fallen stomach" usually attributes all complaints to this cause. Since the floating kidney went out of style, the reflex appendix is becoming less popular, and the roentgenogram of the stomach more popular. It seems a pity to inform such a patient of his visceroptosis. If he is so informed, then more emphasis should be placed on habit and debility as the cause of the fallen stomach than on the gastropptosis itself. Gastropptosis should be the last recourse as an organic diagnosis, because, after all, "it makes no difference where the stomach is but how it works."

Functional stomach disturbance may well be divided into two groups, in the first of which operation has not, and in the second has, been performed without relief; and the second group is larger than is right.

POSTOPERATIVE DISTURBANCES. The surgeon often rightly blames the internist for being too anxious to complete a refined diagnosis on an "acute abdomen;" the internist may at least as often blame the men doing surgery for not more carefully eliciting and recording a full pre-operative history, with complete diagnosis in every chronic complaint.

FINDINGS IN 1000 PATIENTS EXAMINED FOR STOMACH COMPLAINTS.

Present clinical diagnosis.	Number.	Number points.	Previous operations.			
			Appen- dix.	Gall- bladder.	Stomach.	Pelvis.
Organic gastric . . .	141					
Carcinoma . . . 38		3	2	1		
Gastric ulcer . . . 16		5	3	..	2	
Duodenal divertic- ulum . . . 1						
Duodenal ulcer . . . 83		16	9	3	6	
Hair ball . . . 1						
Gastric syphilis . . . 1						
Sarcoma . . . 1						
Reflex gastric . . .	345					
Appendix . . . 78		1	..	..	..	1
Gall-bladder . . . 155		36	23	9	1	6
Constipation . . . 71		18	15	..	1	3
Colitis . . . 27		7	5	..	..	3
Pelvic . . . 13		2	2	..	..	2
Tapeworm . . . 1						
Systemic disease . . .	181					
Pernicious anemia . . . 10		0				
Syphilis . . . 19		3	2	..	1	2
Tabes . . . 5		2	1	..	..	1
Circulatory . . . 50		3	2	1		
Lungs . . . 28		4	2	..	..	1
Kidneys . . . 17		3	1	..	..	1
Migraine . . . 16		4	2	..	1	
Others . . . 36		1	1			
Functional . . .	252					
Neurosis . . . 156		42	31	4	2	20
Hyperacidity . . . 44		8	8	1		
Achyilia . . . 42		10	6	..	1	3
Psychic . . . 10		1	..	..	..	1
Unclassified . . .	59	13	7	3	1	3
Postoperative . . .	22	20	8	6	3	9
Totals . . .	1000	202	130	28	19	56

Of these 1000 patients, 202 had already had the abdomen opened before we saw them. Pelvic work had been done on 56 of the 458 women in this series, and 38 of these 56 we could only call functional complaints. More than half of the patients previously operated on were diagnosed as having extra-abdominal or no objective pathologic condition, and yet I do not believe that our profession in the West is particularly derelict in diagnosis or overenthusiastic surgically as compared with other sections of the country.

One hundred and thirty patients stated that the appendix had been removed, and it is safe to say that this number would more closely have approached the total number of abdominal operations if the full facts could be ascertained. We have tried to establish how often stomach trouble has been relieved by removal of the appendix, leaving out those patients known to have had the appendix removed on account of acute attacks. Somewhat more than one-half of such patients stated that their symptoms were unchanged by operation. Sufferers from migraine and from tabes lost the appendix to cure their disease, and 30 patients lost the same organ for relief of what later proved to be peptic ulcer or gall-bladder disease; but the large majority of unrelieved patients were suffering from an indigestion of functional, not organic, origin.

Careful history would have saved many of these patients unnecessary operation. (I might add that a few of our own patients operated on for a "reflex appendix" still come back to disturb us.) The appendix is held accountable for stomach disturbance far more frequently than operative results have justified.

CONCLUSION. In these 1000 patients:

1. Fourteen per cent actually had organic gastric disease.
2. The roentgenologic examination determined these cases accurately and with a very small percentage of error. Its negative value is therefore very high.
3. Thirty-four per cent showed abdominal extragastric disease giving reflex stomach disturbance.
4. Inflammations of the gall-bladder apparently caused more stomach disturbance than any other organic abdominal lesion.
5. Eighteen per cent presented themselves for diagnosis of stomach trouble which, investigation showed, was due to demonstrable systemic disease.
6. Twenty-five per cent presented no objective pathologic condition. Their complaints were considered secondary to habits of living, type of individual, or to chronic debility.
7. One-third of all cases in which operation was previously performed fell into the functional group.
8. Six per cent of all cases remained undiagnosed.
9. Thirteen per cent, or more, of patients complaining of chronic stomach trouble had lost the appendix before coming to the clinic.
10. Ten per cent of all women in this series had had previous pelvic operations, one-half done on frankly neurasthenic individuals.

Motor Phenomena Occurring in Normal Stomachs, in the Presence of Peptic Ulcer and Its Pain as Observed Fluoroscopically. Reynolds and McClure¹ take exception to a statement made by the reviewer in the Oxford System to the effect that the pylorus did not open with every antrum or peristaltic contraction.

This series of studies embodies the fluoroscopic observations on the stomachs of normal individuals and those having duodenal and gastric ulcer, after feeding a meal consisting of meat and barium. The normal individuals were studied to obtain data on normal motor activity, while the observations on individuals with diseased stomachs were observed to note the motor phenomena associated with the pain intervals.

(The reviewer has fluoroscoped approximately 1000 stomachs a year for the last five years, always using the barium suspension, and from his observations on these stomachs, many of which were normal, the statement that the pylorus relaxes with each peristaltic contraction is one which he cannot accept.)

There is also a difference in the time interval observed. In the beginning of the meal the pylorus is much less apt to show regular relaxation than at a more advanced period, when the gastric contents have been reduced to a consistency favoring evacuation.

¹ Archives Internal Medicine, January, 1922, No. 1, vol. 29.

(In our opinion there is a marked specificity in pyloric action to the nature of its contents, and this must, in a sense, determine pyloric action.—Reviewer.)

Five types of abnormal motor phenomena were recorded: (1) Exaggerated type of normal peristalsis; (2) irregular peristalsis; (3) anti-peristalsis; (4) pylorospasm; and (5) the presence of an incisura in the greater curvature.

1. Exaggerated type of normal peristalsis. This type was observed with 7 patients with ulceration of the first part of the duodenum. In 1 individual this type changed to the irregular type on the onset of pain, and in another subject, the change from exaggerated to irregular peristalsis took place without pain.

2. Irregular peristalsis was observed in 7 patients, characterized by a marked variation in the time of appearance, duration and depth of the peristaltic waves. It began with the onset of pain in 5 patients, and after the onset of pain (either through natural means or after the administration of sodium bicarbonate) peristalsis became of nearly normal type.

3. In 2 patients there was pylorospasm with demonstrable reverse peristalsis.

4. Pylorospasm is defined by the authors, judging by its fluoroscopic picture, as a failure to open its normal width. This phenomenon is usually intermittent.

5. Incisura: In 1 case a small penetrating ulcer occurred on the outline of the lesser curvature. In 4 patients a small incisura developed in the greater curvature, coincidently with the onset of pain.

Regarding the phenomena associated with pain, this symptom was observed in 12 patients with peptic ulcer. In 10 of the 12 its approach was accompanied by distinct modifications of whatever motor activities the stomach had previously manifested. If the stomach showed exaggerated peristalsis and pylorospasm, then the approach of pain was accompanied by an increase in the depth of the waves, or an exaggeration of the degree or duration of pylorospasm. If there was irregular peristalsis, then the peristalsis became more irregular or ceased altogether. If peristalsis had been normal before the pain appeared, then it either ceased or became irregular after the approach of pain. In 4 cases a small, but definite, incisura appeared on the greater curvature.

After the cessation of pain, peristalsis became normal or nearly so, and the stomach rapidly emptied itself, except in 2 cases where exaggerated peristalsis with intermittent pylorospasm remained. Mention is made of the effect of sodium bicarbonate. In 1 case the abnormal motor phenomena, as well as the incisura, disappeared, while in the other all pain disappeared ten minutes after the administration of three grams of sodium bicarbonate—but gastric peristalsis remained unaffected and the incisura persisted.

This question of the pain, and the motor phenomena associated with it, has been studied with the balloon and kymograph by Carlson, Hardt, Hamburger, Homans and others. Carlson and Hardt state that the pain of ulcers is due to the contractions of the musculature of the stomach, pylorus, or the first portion of the duodenum. The authors

criticize their inferences and term them problematical. Furthermore, from the studies of Reynolds and McClure, and from the reviewer's own observations, peristalsis may be active or passive during the presence of pain. One point is clear, and that is alterations in peristalsis may be observed by the fluoroscope that are not recorded by the balloon method.

An interesting observation is recorded in which the pylorus was relaxed during the pain interval, but in which pylorospasm occurred as soon as the pain disappeared. Certainly, from the evidence presented in this paper, and even from those above mentioned, there is no conclusive evidence to warrant the assumption that pain is purely a motor phenomenon. The authors are of the opinion that there is an alteration of motor activity in the stomach during pain intervals; but it is nevertheless true that pain may occur in the absence of peristalsis. We agree with the authors in the statement, "Our observations do not furnish conclusive proof of the truth of this theory (that gastric and duodenal motor disturbances are invariably associated with pain) and for this reason, it must be admitted that the causal relation of motor phenomena to the pain of peptic ulcer remains problematical."

Bacteriology of the Fasting Stomach and Duodenum: An Experimental Study Based on Findings in 30 Dogs. Poppens¹ points out that this subject is one of great interest to the clinician, inasmuch as it must be evident that the intake of bacteria into the stomach is nothing short of enormous. There is no question that the hydrochloric acid of the gastric juice is the important factor in combating bacterial activity in the stomach. A further consideration is the fact that the active factor is the free hydrochloric acid. Many organisms have the power of multiplying in the presence of a considerable degree of combined acid. Miller, many years ago, demonstrated that the number of bacteria in the stomach decreased as digestion proceeded; Gillespie likewise showed that there was a marked reduction in the number of bacteria during the period of digestion.

The author studied the bacteriology of the stomach in dogs. The animals were kept on a mixed diet of bread and meat for fourteen hours previous to the operation. With aseptic technic the stomach and bowel were opened, and some of the contents withdrawn with a sterile pipette. They were inoculated into dextrose broth, and, after eight to twelve hours, subcultures were made on blood agar plates, dextrose agar tubes, plain agar slants, (anaërobic) and litmus milk. The conclusions which this author reached are as follows:

1. By taking two to four drops of material from the fasting stomach and duodenum of dogs a variety of organisms were invariably found.
2. *Bacillus coli* was found much more frequently in the duodenum than in the stomach (4 times out of 15 in the fasting stomach, 12 times out of 15 in the fasting duodenum).
3. Non-hemolytic streptococci were rarely found in the stomach or duodenum (4 times in stomach and 4 times in duodenum, and hemolytic streptococci not at all).

¹ American Journal of the Medical Sciences, February, 1921, **161**, 203.

4. *Staphylococci* were found in 11 of 15 stomachs, and in 3 of 15 duodenums.

These results are important, and emphasize the normal frequency of organisms capable of playing a pathologic role in the system. It is of interest to mention some observations made by the reviewer:

In duodenal intubation of healthy adults, in 6 cases only 1 gave sterile cultures, and 4 gave colon bacilli, and 1 non-hemolytic streptococcus. Furthermore, while the figures are not available in the large number of duodenal intubations which we have performed, probably more than 70 per cent showed the colon bacillus. It therefore becomes an extremely difficult task to state whether or not the isolation of bacteria from the duodenal and the gastric contents is evidence of infection, or whether, pending our more complete understanding of the bacteriology of these parts, it is simply a normal incidence. The reviewer considers a culture evidence of infection when it is accompanied by other evidences of infection, and also when the cultures are pure, abundant and persistent. This latter statement is in a sense confusing, but on one point I am convinced, that in infections cultures are persistent and profuse, while the non-infected individual shows a varying output. (Reviewer.)

Regarding the duodenum, Lenbuscher showed that the bactericidal action of the bile and pancreatic secretion was very slight, if present at all. Gessner, who examined the duodenal contents of 18 persons, demonstrated a number of organisms.

A New Intestinal Tube, With Remarks On Its Use In a Case of Ulcerative Colitis. Max Einhorn¹ has devised a long, jointed intestinal tube, somewhat after the fashion of his duodenal tube. It is 15 to 20 feet long, quite thin, being made of 8 mm. tubing, and consists of "joints" of about 1 meter each, with metal fittings at each end. The distal end is a piece of tubing some 20 to 25 cm. in length and about 20 F. in caliber, containing at its proximal end a stopcock.

A description of a case of ulcerative colitis is given in which the tube was passed into the cecum and the patient treated through the tube. In this way an appendicostomy was avoided and the patient was apparently cured. He subsequently passed the tube in the stool, the distal portion with the stop-cock being first detached.

Gastric Tetany. Carsaet and Augistrou² discuss a fatal case in which tetany was associated with a pyloric tumor, and gastroenterostomy was performed, but the patient did not survive.

Tetany is a serious condition met with occasionally in the course of gastric disturbances. Robin claims that he saw only 2 cases of gastric tetany in 10,000 dyspeptics.

The etiology, according to the authors, is usually gastric stasis secondary to pyloric stenosis, although Bouveret and Devic, in their memoirs, say that occasionally tetany is encountered without stasis or hypersecretion.

The typical attacks are discussed with tonic convulsion of the hands and the characteristic "main d'accoucheur," as the French call it, a

¹ American Journal of the Medical Sciences, April, 1921, 161, 546.

² Jour. de Med. de Bordeaux, January 25, 1922, No. 2, p. 39.

term as descriptive as any. In other cases, such as the one mentioned, the thumb is forcibly adducted into the palm and the fingers are tightly flexed over it, so forcibly as to indent the skin with the nails. The contractions of the inferior extremities usually follow the manifestations in the upper extremities, although occasionally they may be alone affected. It is often possible to induce contractions by pressure on the nerve trunks or the vessels. This, of course, is the Trousseau sign, while the Chvostek sign is similar, namely, light percussion over the nerve induces spasm. Erb demonstrated the galvanic and faradic hyperexcitability of the muscles contracted.

Bouveret and Devic describe three forms. The first is the one described above; the second type is more general, involving the neck, trunk and face, and it is in this latter form that the serious systemic disturbances become manifest, such as persistent vomiting, dyspnea, pupillary contraction, weakness in pulse-rate, elevation in temperature, cerebral troubles, delirium, coma, albuminuria and profuse sweats. A third form is characterized by a series of tonic and then clonic spasms, resembling epilepsy.

As to the pathology, many theories have been evolved which we might enumerate somewhat as follows: Kussmane, who believed it was due to dehydration of the blood; Müller found polycythemia; Flexner, and others, observed contractions of the extremities associated with severe diarrheas. Certain authors have been able to induce attacks with intravenous injections of concentrated salt solution. Fleig, with 30 per cent hypertonic solution of glucose, demonstrated similar phenomena. So, too, in certain forms of nervous polyuria, the same nerve excitability is seen. It has also been reported in the severe diarrheas.

Pylorospasm in Adults: Its Medical and Surgical Treatment. Finney and Friedenwald's¹ article discusses the important point of pylorospasm. The reviewer can recall several occasions in which distinguished members of the profession expressed themselves as doubtful of the existence of pylorospasm. An article such as this is therefore timely, inasmuch as it attempts to summarize the clinical evidence supporting the syndrome of pylorospasm, and gives a résumé of case histories describing typical cases.

There is no doubt in the reviewer's mind that pylorospasm is an exceedingly common condition, and that minor degrees of pylorospasm account for many of the forms of upper abdominal indigestion. Mention is made of the nerve supply of the pylorus and the role which the autonomic system plays in its forms. We are now satisfied that the vagus contains the activator fibers, stimulation of which induces spasm, increased acidity and increased secretion. On the other hand, the inhibitory fibers are supplied by the sympathetic system, stimulation of which inhibits spasm. It is noted that stimulation of the vagus in rabbits induces pylorospasm, while Rogers has produced, in more thorough fashion, the same phenomenon in dogs by the injection of certain extracts of the thyroid, parathyroid and gastric mucosa. Such injec-

¹ American Journal of the Medical Sciences, October, 1921, No. 4, 162, 16.

tion increased both motility and secretion, both of which were inhibited by the injection of atropine. The same thing can be affected by the injection of the adrenal extract which stimulates the sympathetic side. The cause of pylorospasm, according to Rogers, is a continued failure of the sympathetic side, best relieved by pyloroplasty. Cannon's researches on the acid control of the pylorus are of course open to considerable criticism. They do not explain the emptying of the stomach in gastric achylia, the emptying of water, the evidence on the roentgen-ray screen that material leaves the stomach long before acidity has reached a grade sufficient to induce the phenomenon, nor do they explain the evacuation of alkaline meals from the stomach. The suggestion of Lockhart, Phillips and Carlson that certain motor activities of the stomach are associated with relaxation of the pylorus, would indicate a marked association of muscular tonus with pyloric function. McClure and Reynolds, it will be recalled, were unable to produce contraction of the sphincter by the injection of acid into the duodenum. All this evidence simply emphasizes the complexity of the pyloric mechanism, dependent not only on the tonus of the nerve mechanism of the pylorus, but likewise on the condition on the endocrine regulatory apparatus as well as the conditions affecting the latter.

These authors divide pylorospasm into the neurotic, irritative and reflex groups. This classification of course is based on whether the pylorospasm is associated with a pure neurosis, or with an irritative condition in the stomach wall itself, or is due to an extragastric lesion, removal of which results in a disappearance of the spasm. While a pure spasm of the pylorus can occur as an entity in itself, apart from any other recognizable provocative factor, nevertheless the majority of cases are associated with lesions in the stomach or outside the stomach. Gastric and duodenal ulcer, cancer of the pylorus, enteroptosis, gall-bladder disease, appendicitis, renal disorders and diseases of the male and female genito-urinary organs are given as causes. These undoubtedly are associated with pylorospasm, particularly gall-bladder and appendiceal diseases, and one of the worse cases the reviewer has ever seen was associated with the passage of a renal calculus. On the other hand, no mention is made of pylorospasm associated with focal infections, and particularly those in the upper respiratory tract. Some of the severest types are seen in the hypersecretory crises associated with duodenal ulcer. The symptoms are given as follows:

1. Mild discomfort and pressure in the epigastrium two to three hours after meals, and often accompanied by acid eructations and regurgitation.
2. If the spasm is intense, severe pain with vomiting radiating from the median line into the back is found.
3. At first periodic spasm, later continuous spasm, associated with food retention.
4. In severe cases vomiting relieves temporarily, precisely as it does in dilatation of the stomach, and relief can also be obtained by lavage.
5. Vomiting is often explosive in character, resulting in the emission of a large quantity of acid contents.
6. During the attack physical examination reveals a tender area over

the pyloric region, and in thin walled individuals the pylorus can often be palpated as a firm, tender mass.

7. At sometime during the attack hyperacidity can usually be demonstrated by fractional analysis.

8. Roentgen-ray examination demonstrates the presence of spasm. In this paper little notice is given to this method, probably the most accurate and exact for the demonstration of pylorospasm. On the screen the contracted pylorus, and the inability to manipulate material through the pylorus, suggest but one thing, namely, pyloric obstruction and probably spasm. The observer has at his command the use of atropine or even adrenalin which relaxes functional spasm, but will rarely relax spasm associated with organic disease of the stomach. Spasm due to disease of remote organs behaves differently, and those of nervous or reflex origin usually disappear under the influence of antispasmodics. Intermittent stagnation and even six-hour retention are findings associated with pylorospasm.

The treatment of the condition is naturally treatment of the fault, change of scene, massage, rest, regulation of the diet and even a well regulated ulcer cure. During the attacks, morphine and atropine, or, for pain, codeine with belladonna. Sodium bromide, with chloral, has its advantages, as well as the use of hot applications to the abdomen, and thorough lavage of the stomach. Atropine hypodermically may be used, and Stockton has recommended adrenalin, while Rogers recommends the administration of adrenalin nucleoprotein. In intractable cases which have resisted all treatment pyloroplasty is the operation recommended, and even in gastric ulcer unrelieved by gastroenterostomy this procedure has its place.

Naturally, every case must receive careful medical treatment; failing in this line of approach, the advisability of pyloroplasty can be considered.

The Action of Opium on the Stomach. Jarno and Marko¹ mention the divergence of opinion. The general opinion seems to be that opium increases acidity, tonicity and peristalsis, and also prolongs the gastric evacuation time. The question regarding the action of opium on the stomach comes up as to how this mechanism occurs, and what is the relation between the increased acidity and the delay in evacuation. The authors studied this from several angles. Fifteen experiments were performed on the anacid stomachs. Twelve times the evacuation was delayed, twice it was normal, and on a single occasion it was accelerated. On 6 occasions tonus was normal, 9 times it was increased, and peristalsis was always increased. It would seem, from these experiments on anacid stomachs, that the effect of opium on the stomach was independent of the gastric acidity. The alkaloids of opium close the pylorus even in the absence of gastric free acidity, and the only explanation would be hypertonicity involving the sphincter. On the other hand, the hyperacidity induced by the drug would appear to be due far more to the action of the opium on the

¹ Wiener klin. Wchnschr., October 13, 1921, p. 498-499.

pylorus than the effect of the drug on the mucous membrane. The possibility that the closure of the pylorus prevents the normal alkaline reflex from the duodenum is of course an explanation.

Gastric and Duodenal Ulcer. Brisotto¹ considers the various theories advanced for ulcer as unsatisfactory and proceeds along the following lines. He cuts the vagus of a dog and then repeatedly administers hydrochloric acid by mouth. By disturbing gastric function in this way and realizing an increase in gastric acidity, retardation of gastric motility occurs, a disturbance in the pyloric reflex, and with the induction of these factors ulceration develops. Whether it be angiospasm or muscular contraction, the association of artificially increased gastric secretion promotes autodigestion. In other words, a disturbance of the autonomic system impairs the vitality of the cell elements, with resulting destruction through irritants, and chronicity is produced by a more or less permanence in the lessened vitality of these cells. Simple lesions of the celiac axis, splanchnic nerves, or even the vagus give uncertain results. The failure of ulcer to follow these lesions is ascribed to the functional substitution of the intrinsic gastric innervation mechanism, or Openchowski's ganglion. On the other hand, decapsulated animals develop typical ulcer, and inasmuch as the function of the autonomic systems is closely linked up to the endocrine glands, and particularly the suprarenals, it is easy to understand why lesions of these two systems should produce ulcer.

Panchet² discusses the *diagnosis and treatment of gastric and duodenal ulcer*. Simple ulcer is most common over the anterior portion of the duodenum or the lesser curvature of the stomach. He believes that syphilis plays some role in ulcer formation. In the differential diagnosis, appendicitis, cholecystitis, enteroptosis, incipient tuberculosis, renal insufficiency, and cardiac and arterial lesions must be ruled out. A careful history, with particular reference to pain, vomiting and hemorrhage, must be made.

The author sees three reasons for operation in ulcer: First, recurrence of the lesion; second, its tendency to predispose to tuberculosis; and third, its tendency to malignancy. He considers chronic ulcer not amenable to medical treatment, but the ordinary case can be submitted to bed rest, bismuth, milk and rigid hygienic treatment.

For surgical treatment of duodenal ulcer, the methods advocated are: (1) Gastroenterostomy, with cauterization and suture of ulcer; (2) duodenectomy, consisting of resection of the duodenal segment; (3) gastropyloric resection when the patient has marked hyperacidity. For gastroenterostomy the mortality is 0.5 per cent, and for gastrectomy 3 per cent; but the cures are 90 to 95 per cent. In 5 per cent of 100 cases of gastroenterostomy, jejunal ulcer developed owing to high acidity. This emphasized the necessity of postoperative dietetic care.

For gastric ulcer, the methods are: (1) Simple thermocauterization; (2) gastroenterostomy best in ulcers near the cardia; (3) gastropylor-ectomy; (4) Moynihan's Y-gastroenterostomy combined with jejunos-

¹ Riforma Medica, Naples, February 6, 1922, **38**, 127.

² Cron. Med. Chir. de la Habana, January, 1922, p. 142.

tomy. The mortality for thermocauterization is 1 per cent, the cures 60 per cent; and for gastrectomy the mortality is 5 per cent, but numbers permanent cures greater than all other procedures.

ROENTGEN-RAY DIAGNOSIS OF GASTRIC ULCER. Ambrose¹ discusses the roentgen-ray diagnosis of ulcer of the stomach. The technic for the examination is as follows:

The night before examination the patient is permitted a soft diet, but no laxative or cathartic is given. The following morning at 5 o'clock the patient is given 4 ounces of barium sulphate mixed thoroughly in water or buttermilk, and made palatable. The first examination is five hours later, and the patient is then placed behind the fluoroscope in the upright position in order to see whether or not there is any barium still remaining in the stomach, and also how far the barium has proceeded through the bowel. If there is considerable barium in the stomach after five hours, it is evidence of gastric retention and is, in the majority of cases, abnormal. If there is not sufficient barium left in the stomach, the author gives the patient another mixture of the same ingredients and, with his gloved hands, proceeds to palpate the lower end of the stomach and duodenum, first in the antero-posterior direction and then in the oblique position.

Signs of ulcer consist of a deformation of the duodenal cap, such as an indentation, niche, and a partial filling defect or an accessory pocket indicative of perforation.

The next step in the program is to press the shadow upward, putting the hand on the lower pole of the stomach and pressing upward in such a way as to determine whether or not there are any filling defects in the contour of the stomach. If, at this time, any evidence of gastric or duodenal ulcer is found, the patient is given a hypodermic of $\frac{1}{50}$ of a grain of atropine, and, after a sufficient length of time, the patient is reexamined. If the deformities are still present, the assumption is that the condition is not spastic but is due to some real pathology. At this point, if necessary, exposures can be made and plates recorded. The author also makes a mental note of the condition of the heart and lungs, as well as the esophagus and cardiac end of the stomach when the patient first drinks the mixture.

Roentgen-ray examination is also used to observe the results of treatment in ulcer, particularly from the medical standpoint. In the study of the duodenum, a number of contributions have been made.

Crane² discusses the question of *duodenal deformity in relation to the symptoms presented* and the form of gastric acidity. While it is true that a deformity of the duodenal cap may be due to other conditions than ulcer of the duodenum, and while it is equally true that ulcer of the duodenum may exist in the presence of an apparently intact cap, nevertheless we are all of the opinion that this form of deformity is the most characteristic thing in chronic ulcer. This does not rule out the necessity for making the other examinations. Crane has reviewed 1000 cases with gastric symptoms and discusses, in a general way, the associated findings.

¹ Journal of the Missouri State Medical Association, May, 1922, 19, 212.

² Journal of Radiology, June, 1922, 3, 218.

Gastric analysis made on 5 to 6 samples taken at fifteen minute intervals gave four types of curves: 1, the regular half moon form with the height of the curve in the middle; 2, an ascending type with the height of the acid curve in the final sample; 3, a descending curve with the initial high acidity; 4, a sustained curve with a high initial acidity which is maintained throughout digestion.

Gastric ulcer was diagnosed in 126 cases of this series. In 94 of these the acid curve was plotted, in 49 the curve was of the ascending type, in 24 of the sustained type, in 16 of the regular type, and in only 5 of the descending type. In a case of doubtful deformity of the bulb, Crane would consider the presence of the curve of either Type II or ascending type, or Type IV or sustained type as pointing to a diagnosis of ulcer. Of 1000 cases, 413 showed hyperacidity, 119 showed a total absence of free acid. The diagnosis of duodenal ulcer was made in 126 cases, of gastric ulcer in 26 cases, and of duodenal cancer in 1 case. Duodenal ulcer below the bulb occurred on 2 occasions. In only 25 of these 126 cases was an operation performed, although it was advised in many more, but the great majority of patients showed prompt and satisfactory recovery under the Sippy treatment. In 4 of the cases coming to operation, ulcer could not be found. In 1 of these, although there was a persistent bulb deformity, the history and gastric analysis did not confirm ulcer; and in another the bulb was normal, but the history, in the presence of hyperacidity, pointed to ulcer.

Crane is of the opinion that the sound diagnosis of ulcer should rest on three factors: Ulcer history; the demonstration of hyperacidity; and the demonstration of bulb deformity. He strictly insists on the consideration of all the clinical records before the roentgen-ray plates are examined because they help to reduce the errors in diagnosis.

Carman¹ discusses the *errors in the roentgen-ray diagnosis of duodenal ulcer*. According to this author, the two most trustworthy indications of ulcer of the duodenum are the deformity of the duodenal cap and the combination of retention and hyperperistalsis. In large, but otherwise normal, stomachs, according to Carman, the frequent causes of error are spasm from reflex causes, adhesions around the duodenum and gastric lesion near the pylorus. Duodenal spasm is most frequently associated with inflammation of the gall-bladder and of the appendix. On the other hand, gastric lesions near the pylorus may include the duodenum, and thus make a diagnosis very difficult.

Neoplasms, especially benign and malignant tumors of the duodenum, as well as duodenal diverticula, are rare. In Carman's series of 522 cases which went to operation with a diagnosis of duodenal ulcer, in only 23 was ulcer not demonstrated, and in 22 of these there was a disease of the gall-bladder or appendix, or adhesions around the duodenum, or other conditions which required surgery. In only 1 case of the 522 was nothing found to explain the diagnosis. On the other hand, of 544 cases in which the diagnosis made was something other than ulcer, 32 proved on operation to have an ulcer of the duodenum. It

¹ Journal of Radiology, May, 1922, 3, 163.

therefore is evident that the percentage of negative errors slightly exceeds the percentage of positive mistakes.

It might be well to recall, in this instance, that Carman's method of duodenal study is the administration of a barium suspension, usually with syrup, and the palpatory maneuver by which the bulb of the duodenum is filled out to the gastric shadow. This method is by far the most satisfactory in adequately demonstrating the cap of the duodenum.

Guenaux and Vasselle¹ discuss the *roentgen-ray diagnosis of ulcer of the duodenum*. These authors examined the patients successively in various frontal and oblique positions. They claim that while the antero-frontal position gives one an exact topographic situation of the duodenum, it frequently leaves much to be desired so far as the appearance of the whole organ is concerned. The antero-oblique position separates the gastric and the duodenal shadows. The various parts of the duodenum then become apparent. The entire length of the bulb can be readily inspected in the recumbent position. The abdominal position, with inclination to the right side, is used by these authors so that the bulb and second portion are seen clearly, and in many instances the passage of the material into the third and fourth portions may be followed without much difficulty. Furthermore, a series of films are taken to register the findings in the organ. According to these authors, the direct signs are those constituted by the deformation of the duodenal image. Diverticular forms are rare and may be sessile or pediculate, the latter form corresponding to a perforated ulcer, although this picture cannot be distinguished from a true diverticulum of congenital origin. A small nick in the bulb is a sign of ulcer in the majority of cases, and in most instances spasm will exaggerate the deformity. Extensive deformity of the duodenum may be due either to ulcer internally or to adhesion formation to the gall-bladder externally. The indirect signs may be mentioned as hypertonicity of the stomach and not infrequently exaggeration of the peristaltic contraction of the stomach. According to some authors, there is abnormally rapid evacuation of the stomach in some 75 per cent of cases of duodenal ulcer. Furthermore, the question of the position of a tender spot can be investigated, although too much dependence must not be placed on this finding. It must be borne in mind, for instance, that the duodenal and gall-bladder shadows are frequently superimposed.

Vilvandre² reports a case in which a nail and a safety pin were swallowed. On roentgen-ray examination the nail was in the second part of the duodenum. It was later removed by operation and had not caused perforation.

Hochstetter³ mentions a case of old tuberculous peritonitis which succeeded in producing stenosis of the duodenum by means of adhesive bands. The stomach was also embedded in this material.

Quiby⁴ discusses a case in which roentgen-ray evidence showed an

¹ Paris méd., April 1, 1922, **12**, 284.

² Arch. Radiol. e. Electropher., London, April, 1922, **26**, 249.

³ Fortsch. a. d. geb. d. Roentgen strahlen, April 22, 1922, **29**, 176.

⁴ Bull. et mem. soc. de radiol. med. de France, March, 1922, **10**, 84.

interesting form of duodenum. It was quoted from the case that there was duodenal stasis due to constriction or adhesive formation, the diagnosis which was confirmed by operation.

STUDY OF THE EARLY EFFECTS OF THE SIPPY METHOD OF TREATING PEPTIC ULCER. Shattuck¹ discusses the Sippy treatment as practiced at the Post-Graduate Hospital, New York, and reviews the effect on 28 cases under observation from six months to two years. Cases were carefully selected in which typical history and typical roentgenologic evidence of ulcer were present, and all cases of organic stenoses, hour-glass stomachs and perigastric adhesions were omitted. After complete study, history, gastric analysis and roentgen-ray study, patients are placed under the Sippy treatment, remaining three weeks in bed, getting up gradually and resuming their normal life after the fourth week.

The following extract is from Shattuck:

"At first, hourly feedings of a milk and cream mixture are given; later cereals and eggs are added, and still later, other soft, palatable foods, such as cream soups, custards, jellies and vegetable purées, are allowed. The diet is further slowly enlarged until, at the end of from nine to twelve months, it is unrestricted. From the beginning, alkalis are given hourly in sufficient amounts continuously to neutralize the free hydrochloric acid. The amount of alkalis required to accomplish this is determined by testing samples of the gastric contents aspirated with a duodenal tube, and increasing the amount until further testing shows that no free hydrochloric acid is present. They are continued from eight to twelve months. This is the distinctive feature of the Sippy method. All discovered foci of infection are eradicated, if possible. In addition, those factors which influence gastric secretion and motility, such as mental or emotional strain and fatigue states, receive appropriate attention. Just before leaving the hospital, the gastric chemistry is again examined; occult bleeding again looked for, and a second roentgen-ray examination is made. The patients are then followed and studied in the same way, for one, two or more years. These observations are not complete in some of the cases. The periods of observation vary from six months to two years."

The effects of the treatment might be enumerated as follows: Twenty-two were duodenal, and 6 were gastric, ulcers. Twenty-two out of 28 remained free from pain since the beginning of their treatment. Of the remaining 6, 1 died, 2 were operated upon, 1 with complete relief and the other with partial relief. Of the 11 patients followed from one to two years, 9 have remained entirely free from symptoms, 1 is partially relieved, and the other only partially relieved after an operation.

Regarding the effect on the gastric chemistry. It will be recalled that Crolin and Reiss studied the results of a restricted diet in 34 cases, during a period of two to five weeks. They found that medical treatment reduced the acidity in less than half the cases, but that more than 50 per cent of the patients whose acidities were unaffected, left the hospital symptom-free. They furthermore showed that 50 per cent

¹ Journal of the American Medical Association, October 22, 1921, No. 17, 27, 1311.

of the patients discharged free from symptoms still retained their hypersecretion. Of 7 cases which were observed from the standpoint of gastric chemistry, 3 showed a distinct reduction in gastric acidity and 4 did not.

Ten patients, followed a year or less, were examined for hypersecretion by the fractional method. It was present in 6, and reduced during medical treatment in 2. Two of the 4 patients with persistent hypersecretion became symptom-free and 2 did not.

Occult blood was present in 6 of 28 cases, and in each instance, under medical treatment, the occult blood became negative before the end of the third week and remained negative.

Regarding roentgen-ray studies of healing ulcers, Friedenwald and Baetjer found little change in the first two weeks, but after prolonged medication, distinct roentgen-ray evidence of healing. White has seen the crater or niche along the lesser curvature almost entirely disappear under medical treatment, and with duodenal ulcer, he found the deformity greatly reduced, but rarely completely gone, owing to scar tissue and adhesions. Favorable changes were noted in the duodenal deformity in this series, and in 5 out of 6 cases the "niche" and six-hour retention disappeared under treatment.

Summary. (Shattuck.)

"1. The effects on the symptoms, gastric chemistry, evidences of occult bleeding and roentgen-ray findings caused by the Sippy treatment were studied in 28 cases of peptic ulcer, 6 gastric and 22 duodenal, over periods of from six months to two years.

"2. Twenty-two of the 28 patients have remained free of symptoms throughout the period of observation. Eleven patients were followed from one to two years with complete relief in 9, and unsatisfactory results in 2. Of the 17 patients followed for less than a year, 13 have remained symptom free, and 4 have not.

"3. Of the 17 patients studied with the Ewald test-meal or the fractional method, 10 showed no marked reduction in acidity, though all but 2 were rendered free from symptoms. Hypersecretion was detected in more than half of the cases examined. It was reduced by treatment in less than half of the cases, though some cases with persistent hypersecretion were made symptom-free.

"4. Six of the 20 patients showed occult blood in the stool. It disappeared in all cases after three weeks.

"5. In 18 cases, comparative roentgen-ray studies were made from six months to two years after beginning treatment. Five of 7 patients with duodenal ulcer, followed from one to two years, showed evidence of favorable roentgen-ray change; 2 did not. All 6 duodenal cases followed from six to twelve months showed some favorable roentgen-ray change. Six cases of ulcer of the lesser curvature of the stomach were followed. The niche deformity and six-hour residue disappeared during treatment in 5 of these.

"The purpose of this study is not to advocate the value of medical treatment in general, nor of the Sippy method in particular. It is merely to report some of the effects of this method. It is well known

that with all the diagnostic help that has come in the last few years, the diagnosis of peptic ulcer, even in the hands of the most skilful, is still subject to error. Apparently, in some cases, nothing short of opening the stomach or duodenum can settle the question. How large an element of error there is in this series of cases, I have no way of knowing. Furthermore, long remissions followed by recurrence of symptoms are so frequent in peptic ulcer that we should follow the cases for a much longer period than the average period of observation of this series before making any final conclusions. However, the effects of the Sippy treatment, even in this comparatively small series, are interesting, and this method of study should lead eventually to a better understanding of the value of the various medical and surgical procedures used in treating peptic ulcer."

ACUTE PERFORATION OF GASTRIC AND DUODENAL ULCER. Noehren¹ gives a number of statistics in this communication which are of interest. In 59,450 autopsies collected by Bassler, ulcer of the stomach or duodenum was found in 4.4 per cent of these 5 per cent perforated. Davis is authority for the fact that 20 per cent of all duodenal and 7 per cent of all gastric ulcers perforate. Musser found 28.1 per cent of perforations in 1800 cases. As to the immediate cause of actual perforation, the most common is overloading of the stomach, and next to this a pull or blow on the weakened gastric wall.

In this series of 5 cases of perforation discussed by the author, 1 case occurred while the patient was eating; another while the patient was working on the farm; 1 while the patient was working as a carpenter; and 1 during vomiting caused by the original ulcer. In the fifth case, however, perforation occurred while the patient was in bed early in the morning while the stomach was empty, a not infrequent occurrence according to the literature. In fact, one might say that ulcer of the stomach or duodenum may perforate at any time. Perforation is more common in men than in women, and, according to the various cases, the relative frequency of perforation differs. Farr reports more gastric than duodenal perforation in 24 cases. Hertz reports 47 gastric and 13 duodenal cases; Petren, 65 gastric and 27 duodenal cases; Struthers reports only 18 gastric and 72 duodenal cases; Wise, 4 gastric and 5 duodenal cases; Gibbson, 7 gastric and 7 duodenal cases; but all 5 cases reported by this author were duodenal.

Regarding the possibility of multiple perforation, Eliot collected 26 such cases in all the literature. Regarding the symptoms, the two most important are pain which is apparent to the patient and rigidity which is evident to the physician. The pain is sudden and excruciating in character. It is so severe that the patient immediately gives up what he has been doing and assumes a strained, immovable position. Furthermore, it is a continuous pain, which enables one to distinguish it from acute intestinal obstruction and colic indigestion. It is usually in the epigastrium, but in many instances travels down the right side toward the right iliac fossa so as to suggest the possibility of appendicitis. In

¹ New York Medical Journal, June 7, 1922, p. 674.

fact, after peritonitis has intervened, it is practically impossible to make a diagnosis. In the cases, however, of ulcers away from the pylorus, leakage may be on the left side. The muscle rigidity is so pronounced that the abdomen is as hard as a board. Usually, in some of these cases, it is possible to obtain a previous history of indigestion, but instances are not lacking in which no such history was obtainable. The author also mentions the fact that vomiting is not a striking symptom, often occurring only once or twice before peritonitis sets in. Dulness in the flanks is a valuable symptom when obtained, but its absence does not exclude perforation. Absence of liver dulness seldom exists, according to this author. The absence of any elevation of temperature or increase in pulse rate during the first year is an important point to remember. In this series of 5 cases, leukocytic count was made in only 1 case, showing 15,000 leukocytes and 90 per cent polymorphonuclears. In these cases it is of the utmost importance to make an early diagnosis, inasmuch as it becomes next to impossible to determine the cause of peritonitis later on in the progress of the case.

Mention is made as to the method of surgery to be employed, but here again the important point is an early diagnosis which is the most important desideratum.

Wieschhammer¹ discusses the *difficulties in the diagnosis of peptic ulcer*. Moynihan's assertion that more errors are made in the diagnosis of gastric ulcer than that of any other abdominal disorder is quoted, and it is pointed out that by far the greatest number of ulcers are duodenal. Reference is also made to the statement of Graham that duodenal ulcers have a longer course in years than those of gastric type, and, therefore, a long ulcer history favors the duodenum as the site of the process. Furthermore, in duodenal ulcer night-pains are usual, helping to confuse this condition with cholelithiasis. On the other hand, flatulent distention of the stomach is more frequent in gastric ulcer and coarse foods are more likely to produce pain. Regarding the question of hyperacidity as an exponent or rather as an aid for the diagnosis of ulcer of the duodenum, reference is made to the statement of Eggleston, that a number of abdominal disturbances reflexly disturb the function and chemistry of the stomach causing symptoms which simulate those of duodenal ulcer. In gastric ulcer, however, the pain occurs usually earlier in the course of digestion and is usually intensified by a full meal, but, as Mayo Robson points out, any one, or all of the cardinal symptoms of ulcer may be lacking. Pain is usually referred to the epigastrium, but it may radiate in various directions, as a rule to the left subscapular region. Reference is made to the position of the ulcer, those near the cardia giving earlier pain, and those near the pylorus giving pain two and three hours after the ingestion of a meal.

Later in the course of gastric ulcer, complications may arise, including perforation; adhesion contractions; dilatation of the stomach due to obstruction; fistulae between the stomach and pylorus with the

¹ New York Medical Journal, June 7, 1922, p. 672.

joining organs; local peritonitis ending in adhesions, suppuration or even abscess; abscess of the liver, pancreas or spleen; pressure on, or pressure of, the bile ducts, producing jaundice.

Regarding the question of penetrating as contrasted to perforating ulcer reference is again made to the remark of Eggleston, in which a penetrating ulcer is one which burrows through the outside stomach wall into neighboring organs, such as the liver and spleen. While in a sense it is a perforating ulcer, it is usually surrounded by adhesions so as to prevent the serious consequences which, in perforating ulcer, follow the escape of the gastric and duodenal contents into the abdominal cavity. The penetrating ulcer is distinguished clinically by greater severity of pain, greater local tenderness, and the absence of relief after the ingestion of food and alkalies as is found in the typical simple ulcer.

Perforation is discussed as a symptom of the gravest importance. Ninety-five per cent of these cases result fatally unless operation is immediately performed. Very occasionally, in the subacute variety, medical treatment may be efficacious. Hemorrhage, naturally, is a distressing complication, but with the march of modern surgery the dangers of secondary anemia are obviated through the intervention of transfusion. Although ulcers occur far more frequently on the posterior wall, perforations are far more common upon the anterior. One observer asserts that in at least 75 per cent of cases of chronic duodenal ulcer the patient never consults a physician; while another observer is of the opinion that 30 per cent of those individuals who obtain relief by the administration of alkalies really suffer from peptic ulcer. More than 85 per cent, however, are relieved by medical treatment. Often the only symptoms complained of in ulcer is the sudden, short attack of epigastric pain, rarely radiating in character, but which may radiate to the back if posterior perforation is impending. These patients frequently make a sudden and complete recovery suggesting an erroneous diagnosis of gall stones.

In another class of cases there are simple, mild, digestive disturbances ignored both by the physician and the patient, possibly slight gas formation, slight regurgitation or even vomiting. In a differential diagnosis between chronic ulcer and gall stones, digestive symptoms occurring between fifteen and thirty years of age suggest ulcer; later in life the presence of gall stones is more likely. When, however, attacks of severe pain follow each other at short intervals and are repeated from day to day even when acute, the diagnosis must be made with care, inasmuch as such a condition is more often ulcer with perforation than gall stones. Likewise, with the occurrence of great pain night after night, with constant gastric distress, the probable diagnosis is ulcer. Pain that comes on immediately after taking food and is not relieved by alkalies suggests the possibility of appendicitis or cholecystitis. In the presence of symptoms of irregular food distress or pain, anorexia, gas and vomiting the likelihood of appendicitis should not be forgotten. These considerations simply emphasize the necessity for a very thorough examination.

TREATMENT OF GASTRIC AND DUODENAL ULCER. Strachauer¹ discusses the question of treatment of peptic ulcer. As is generally believed, this author is of the opinion that ulcers of the duodenum and stomach are never exclusively medical nor exclusively surgical. The treatment depends upon the type, size, and stage of the ulcer. All uncomplicated, acute ulcers and the majority of ulcers which are recognized at an early stage should be treated medically; and it is generally considered that uncomplicated ulcers of the right type respond promptly to medical treatment. In other words, medical treatment sorts the ulcers into medical and surgical cases. Furthermore, it demonstrates whether the diagnosis has been incomplete or incorrect. The cases designated as incomplete are those having coexisting lesions in the gall-bladder, appendix, pancreas or other organs. Such complications make the ulcer case a surgical one, and not infrequently a case diagnosed as ulcer, which fails to be relieved by medical treatment, turns out to be a lesion of the gall-bladder, appendix, pancreas, liver or spleen.

In discussing the *etiology*, the author mentions the fact that the chief direct cause of ulcer is probably sepsis, a streptococcic hematogenous infection not infrequently causing infection of the gall-bladder, appendix, pancreas, kidney and often other lesions.

Regarding the *symptomatology* of ulcer, the uncomplicated ulcer is usually demonstrated by its secondary and indirect symptoms, consisting of pyloric spasm, hyperactivity of the pyloric end of the stomach, and in some cases hyperacidity and hypersecretion. The uncomplicated ulcer, however, gives no direct symptoms.

Regarding the *medical treatment* of this condition it is realized that many ulcers remain quiescent, and that in many instances the so-called medical cure of ulcer consist of a disappearance of these secondary symptoms, but true healing of the ulcer and relief of the secondary symptoms are different conditions. A true cure means a healing or eradication of the ulcer. Gastroenterostomy relieves pyloric spasm, ensures more rapid emptying and mechanically drains the results of the hyperacidity and excessive secretion. Furthermore, the influx of the duodenal secretions results in a reduction of the acidity, the free 40 to 50 per cent and the combined acidities 30 to 40 per cent.

Regarding the surgical treatment of this condition, we all believe that pyloric obstruction is the true indication for gastroenterostomy. This author believes, however, that the excision of the calloused ulcer should always be combined with gastroenterostomy when this is operatively feasible. Transverse excision of duodenal ulcer and suturing is the operation advised. Ulcer of the stomach or duodenum, when associated with low activity, may at times be appropriately treated by resection or an operation of the Finney type. Perilulcerous edema and inflammations, as well as close proximity to the common duct or posterior wall, are contraindications to gastroenterostomy, but with greater experience in the simple resection of ulcer an increased number of these operations

¹ Minnesota Medicine, May, 1922, No. 5, 5, 290.

will be found, according to this author, and a decreasing number of gastroenterostomies.

The author classifies ulcers as follows:

1. Soft lesion, relatively small, superficial, no deeper than the submucosa; absence of surrounding induration; this runs the benign clinical course and is usually cured by medical treatment.

2. Large size, deep penetration, frequently perforating; marked induration, scar tissue, margin of connective tissue and resulting anemia constitute serious obstacles to healing. Surrounding edema requires resection or eradication with a cautery.

3. Small ulcer, localized with scar and readily resectible.

4. Duodenitis, as recently described by Judd. Stippling, congestion, edema, thickening present but no scar; no crater, but multiple small ulcers present and leukocytic infiltration.

Dietetic and Treatment Regulations in Gastro-duodenal Ulcer. The following excerpt is by Bassler.¹

"The treatment is begun with no food by mouth for twenty-four to forty-eight hours. During this time the patient is given calomel in quarter-grain doses every fifteen minutes for eight doses, and Carlsbad salt twelve hours after finishing and at twelve-hour intervals during the fasting period. Cool, but not iced, water is allowed to be drunk in sufficient quantities to allay thirst. Alkalies are administered from the beginning to neutralize any gastric juice secretion that may be present. During the fasting period, 10 grains each of sodium bicarbonate and bismuth subcarbonate are given every three hours, six doses in all in twenty-four hours, there being an interval of six hours through the night.

"The feeding is then begun. Three ounces of a mixture of equal parts of cream and milk are given every hour from 7 A.M. to 7 P.M. for three days (1835 calories), and the alkaline powders of sodium bicarbonate and bismuth subcarbonate. To keep the bowels open, an alternating powder of sodium bicarbonate and calcined magnesia are given midway between each feeding. This corresponds to the first three days' method of Sippy, and represents about 1325 calories a day. On the evening of the second day of this feeding, note is made if there is any free acid secretion residual in the stomach. This is done usually at 11 P.M. by aspiration of the stomach contents with a fractional test tube and testing the return, or by swallowing a gelatine capsule having an extension of string inclosed in the capsule impregnated with Congo red or dimethyl and dried and withdrawn after being in the stomach fifteen minutes. On the finding of a positive acid, the urine is voided and passed again in an hour, note being made of the reaction of the last specimen. If no acid is present in the stomach (even if the urine is slightly so), no alkalies are given throughout the night for the next fifteen days of the bed treatment. Generally by this time the stomach is negative to acid and urine also. If acid is met with in the stomach and urine also, alkalies are given at three-hour intervals throughout the night for the remainder of the days in bed in quantities to keep the urine

¹ New York Medical Journal, June 7, 1922, pp. 670-672.

alkaline or neutral to litmus paper. Modification here depends upon the reaction of the urine, this being noted at the end of the day and before feeding is resumed in the morning.

"On the sixth day from beginning the treatment, a mixture of eggs cream and milk is given at hourly intervals. Soft eggs and cereals are not employed as Sippy advises, for the reason that whole eggs, and especially when they are cooked, cannot be accurately controlled in quantities. Cooked eggs had better not be given, and no cereals should be given until after the bed treatment is terminated, for they tend to diminish the best results. The mixture I employ is the following:

	Amounts at feeding.	Milk.	Cream.	Eggs.	Calories.	Time number.
6 to 9 days	3½ oz.	25 oz.	25 oz.	2	2050	Hourly 13
9 to 12 days	4 oz.	22 oz.	34 oz.	3	2650	Hourly 13
12 to 15 days	4½ oz.	20 oz.	44 oz.	4	3275	Hourly 13

"From the fifteenth to the twenty-first day the feedings are in five-ounce quantities of equal parts of milk and cream. Four eggs in the day are allowed cooked in any soft way. At this time 40 grams of sugar are allowed, not in the form of saccharose (cane sugar) which stimulates acidity and tends to constipation, but as lactose, maltose, etc. The feedings at this time are extended to two-hour intervals, and the milk and cream mixture on thickly buttered toast at two meals is allowed. (This represents 3450 calories a day.) Effort is made in these six days to lengthen the interval of feedings so that on the twenty-first day meals of milk, cream, eggs, bread and butter and sugar and milk and cream are given at 8, 12, 4 and 8 o'clock, with one or the other of the alkaline powders one hour after each of them, and a milk and cream feeding at 10, 2, 6 and 10 P.M., followed by a powder.

"We must agree with Sippy that the after-treatment of these patients is most important. I find, though, that the hourly feedings with city people are not practicable and feedings of milk and cream hourly between a light breakfast, luncheon and supper, even with the thermos bottle method he advises, need not be followed. For the first month out of bed, I do not allow soft or strained foods, such as jellies, marmalades, vegetables, or leguminous purées as Sippy advises. Instead patients are kept absolutely on the four foods mentioned above, and a diet which represents 3780 calories a day is strictly maintained. Such a diet is given below.

"The diet is a temporary one and is to be continued until a change is made. The plan is not to partake of any solid foods whatsoever and to take the foods that are suggested at regular intervals of four hours during the day, making sure that a strict regularity is preserved and that the foods are divided up rather evenly in quantity for each time. A glass of plain fresh milk and perhaps a few crackers should always be taken between meals and before retiring, and an extra glass of milk during the night if there is distress in the stomach.

"The diet consists essentially of only four foods, namely, eggs, fresh milk and cream, well cooked cereals, bread and crackers, and nothing else in the food or fluid line (excepting plain water) should be taken.

The eggs may be eaten raw or cooked in any form, or may be taken in the milk. The milk may be warmed if desired, but should not be taken too hot or too cold. The ten minute modern breakfast foods or any form of oatmeal should not be eaten, the old fashioned forms of ground corn, farina, rice, tapioca or sago, well cooked, being the best. The bread should not be too fresh (one day old), any of the sweetened or unsweetened crackers can be used, and all forms of simple cake, providing there are no nuts, raisins, seeds or preserved fruits in it.

"The total amount of food in one day should be: Four eggs, 1 quart (4 tumblerfuls) of milk, $\frac{1}{4}$ pound of fresh unsalted butter, or $\frac{1}{8}$ pound of butter and an extra quart of milk, 2 rolls or 4 medium thick slices of white bread, $\frac{1}{4}$ pound of baker's cake or crackers, $\frac{1}{2}$ pint of fresh cream, and $\frac{1}{4}$ pound of cereals.

"On this four-meal-a-day plan with the interval feedings, I use 8 powders each taken one hour after a feeding of any kind. During this first month out of bed the activities of the individual are restricted, this with the initial bed treatment taking eight weeks.

"After the eighth week the 8, 12, 4 and 8 o'clock meals are diversified with the following selections, plain milk being taken midway between meals and the alkaline powders one hour after each feeding: Purées or creamed soups (barley, rice, peas, beans, celery); gruels (flour, cracker, barley, Indian meal, farina). Plain crackers, baker's cake, pound cake, toast, rolls; jellies, rice, tapioca; ground or mashed vegetables; puddings, rice, tapioca, bread, cracker; custards, vanilla and chocolate, blanc mange, whips and souffles; gelatines; plain ice cream; malt, milk cocoa, cocoa and chocolate.

"This is kept up for four months when the following diet is prescribed and the powders changed to a combination of the two which were used before. The following is the combination which is used most frequently:

Magnesia usta	} āā 15
Bismuthi subcarbonatis		
Sodium bicarbonatis		
Sacchari lactis		
Fiat pulv.		

Sig: Take a teaspoonful in water after meals.

"The general plan of the diet is to take three moderate sized meals at regular intervals during the day, and to take supplementary meals of milk, reënforced with cream, cocoa and crackers between meals and before retiring. Although food should be taken at least five times during the day. All of the solid foods should be tender, cut very fine on the plate and thoroughly masticated before swallowing. Olive oil may be taken before the main meals in hypersecretion and hypermotility.

"Foods permitted for main meals are: Beef, lamb, and chicken, roasted or broiled and taken only once a day; fish, any kind and in any form, other than fried, and taken once a day; cereals (with the exception of oatmeal and shredded wheat biscuits) well cooked and taken with cream in the mornings; vegetables, any that are well cooked and mashed with the exception of green vegetables; tubers, such as baked or well-

mashed white potatoes, squash, parsnips and turnips; desserts, any made of milk, cereals and jellies, no fruits, berries or nuts. Butter, cream, milk and cereals and eggs still remain the main foods of the daily diet. If the symptoms become marked again, these should be the main articles of the diet for a while, when the more general plan may be followed. The best drink at the meals is Vichy or any alkaline water.

"At the end of six months a normal diet is employed. The following list of foods that will be especially injurious and must not be eaten is given to the patient:

"One or two minute cooked breakfast foods; rough vegetables such as cabbage, sprouts, cauliflower, artichokes, asparagus, beets, celery, corn, cucumbers, kohlrabe, onions and tomatoes; foods which contain pits, seeds or skins, or nuts; canned or smoked meats or fish; lobster, crab, shrimp; cheese of any kind excepting cream cheese; too much pastry, especially that cooked in molten fat, such as doughnuts and fritters; foods that are too sweet, such as jams; fruits such as cherries, cranberries, figs, grapes, musk melons; coffee, strong tea, alcoholic and malt beverages.

"During the second month roentgen-ray treatments are given to the stomach, these usually being six in number, given at five-day intervals. The patient is roentgen-rayed on an empty stomach which contains 2 ounces of bismuth subcarbonate. The exposure at twenty-four-inch distance is one minute, 5 to 10 milliamperes, five-inch spark gap, 2 millimeters of aluminum and thickness of sole leather used as filters. Occasionally some form of organic iron is taken by mouth or a ferruginous preparation by hypodermic injections."

Doegee¹ discusses the question of the ETIOLOGY OF GASTRIC ULCER. In this article he points out the fact that the theory of trauma to the stomach is superseded by the teaching of the deleterious effect of hyperacidity on the stomach wall, and the selective action of bacteria on the mucous membrane, and lately, of the neurogenetic origin of gastric ulcer. The fact that gastric ulcer is so frequently associated with many general conditions as well as localized phenomena throughout the digestive tract has made Roessle consider chronic gastric ulcer as the secondary disease, secondary to, and following in the wake of, a variety of other primary effects. The idea is that this condition follows the primary one in the sense of being secondary to it and more or less dependent on it.

The author quotes Hart who claimed that 56 per cent of the 166 cases which he studied, showed signs of a definite arterial sclerosis. In Hart's series, there was also 23 per cent of peptic ulcers, histories of which showed that they were effected simultaneously with gall stones. These instances only became apparent in the older cases, however. An affection of the central nervous system was present in only 17.4 per cent of 166 cases. The author, in this discussion, also mentions the theory of bacterial implantation, although he finds he is unable to accept that theory. The spasmogenic theory of Vanberbman is also

¹ Wisconsin Medical Journal, June, 1922, p. 1.

based upon the existence of localized spasm in the submucosa and is presumably based upon a disharmony in the visceral nervous system. The author also quotes the findings of Gundelfinger with his experiments on dogs.

This author came to the following conclusions: (1) That neither vagus irritation nor vagotomy caused organic disease in the stomach or duodenum of dogs. (2) That the celiac ganglion irritation or extirpation lead to unquestioned erosion or ulcer formation in 100 per cent of cases. From this standpoint it would be probably not the vagus, but the sympathetic, system which is at fault. Rather, more, it would seem the loss of the celiac ganglion and the consequent absence of the sympathetic influence of the plexus of Auerbach and Meissner was responsible.

Cause and Prevention of Gastro-jejunal and Jejunal Ulcer. The important factors preceding the appearance of gastro-jejunal ulcer according to Wilensky¹ are: (1) An operation of some kind; and (2) a preëxisting gastric or duodenal ulcer. Regarding the operation, every step in the process is supposed to be associated with a factor which might be concerned in the formation of ulceration, the position of the stoma, the use of the clamps, the use of non-absorbable suture material, marginal necrosis and injury to the tissue; but the wide diversity of opinion favors the idea that these are only incidents. Certainly, if they were causes, the number of gastro-jejunal ulcers would be definitely increased.

The second important cause, according to this author, is the presence of preëxisting ulceration. We believe, however, that most of the motor and chemical alterations in the stomach are secondary. At least, Wilensky does not believe they are primary factors in the production of this type of ulceration. He believes that in practically every instance there is a preëxisting ulceration. He has never seen this type of ulceration follow a gastroenterostomy where the operation was performed in the absence of ulceration or conditions associated with ulcer (carcinoma for instance).

This would seem to indicate that the secondary gastro-jejunal ulcers and the primary gastric ulcer are similar lesions, subject to the same etiological causes and the same type of development.

GASTROENTEROSTOMY. Bonar² studied the stomach in various conditions before and after the operation for gastro-enterostomy. Each patient was submitted to fractional analysis, a chemical analysis of the feces, and an roentgen-ray examination of the stomach. Notes were made before operation, and then the patients were examined six months after operation by means of the test-meal and the roentgen-ray. After gastroenterostomy for prepyloric ulcer and the free hydrochloric acid is lessened, but the total acidity roughly reaches the same level, bile enters the stomach during the meal and the stomach empties more readily. Pyloric ulcers have the same type of curve after operation as before operation; duodenal ulcer has high acid secretion in the rest period, and

¹ New York Medical Journal, June 7, 1922, p. 668.

² Lancet, November 5, 1921.

slightly reduced free acidity during the digestive period. The total reaches the same figures as previous to the operation.

In carcinoma, the total and free acidity are low, both before and after the operation. In all cases the evacuation is accelerated after operation; a varying amount of bile enters the stomach; and finally, in all cases the operation relieved pain.

Clendening¹ discusses the cause of UNFAVORABLE SYMPTOMS AFTER GASTROENTEROSTOMY based on a study of 36 cases. This author prefers the term "unfavorable symptoms" rather than failure, because the symptoms arise from situations dependent on the operation rather than the recurrence of the original disease. The old idea that because the food may continue to go through the pylorus; or that it may enter the jejunum too rapidly; or that a vicious cycle is established, are ideas which have been largely dissipated through exact and accurate observation. This author reviews the physiology of the stomach and also the causes of symptoms. He divides these cases into those in which the patient has symptoms while still in the hospital (immediate bad results); and those which come on later and more gradually, which may be classified as remote bad effects. The early symptoms are frequently postoperative complications, but the causes of the late "unfavorable symptoms" following gastroenterostomy are: (1) Jejunal ulcer; (2) recurrence of ulcer, particularly those on the posterior wall and not infrequently due to lack of proper dietetic regulation; (3) diarrhea from too rapid evacuation, or even an enteritis induced by improperly digested food or bacteria; (4) dilatation of the jejunum from too large a stoma; (5) gastric stasis from high implantation of the stoma; and (6) superimposed gastric disease.

Regarding the Symptoms of Marginal Ulcers Following Gastroenterostomy. Schuldt² discusses this general subject and particularly *pain* after food or without food; pain usually at night; pain of a cramp-like nature; pain in the epigastrium and to the left of the navel and the left rib border; vomiting of blood and blood in the stool.

Moreau³ discusses the *duodenal reflex after gastroenterostomy*, and claims that the so-called vicious cycle so frequently attendant on this operation is not so serious, and rarely gives rise to any disturbance.

Rowlands⁴ in discussing "*vicious cycle or regurgitant vomiting after gastroenterostomy*" says that failures are chiefly due to jejunal ulceration and vicious cycle. This form of regurgitation, according to this author, who speaks from fifteen years' experience, is due to variable degrees of intestinal obstruction at, or near, the anastomosis and is usually the result of faulty technic, or adhesions or contractions developed after operation. Two clinical types are described; one acute vicious cycle and the other chronic. The acute form develops in a few days after operation, and, unless relieved, results fatally. The chronic form shows vomiting, once or twice every few days or weeks, of large quanti-

¹ Journal of the American Medical Association, October 15, 1921.

² Minnesota Medical, April, 1922, 5, 243.

³ Bull. et Mem. Soc. de Radiologie Med. de France, February, 1922, 10, 44.

⁴ Guy's Hospital Reports, London, January, 1922, 71, 68.

ties of bile-stained fluid. Acute attacks occur with severe pain and discomfort, vomiting with loss of considerable fluid, and ensuing thirst. In acute vicious cycle the diagnosis must rule out anesthesia vomiting; hemorrhage; paralytic distension; intestinal obstruction (lower down); and finally, peritonitis. The treatment of vicious cycle is lavage and operation.

Panchet¹ discusses the subject of *jejunal ulcer*. The frequency of this condition is given as high as 4 to 5 per cent, and while one cannot explain the cause, as Wilensky pointed out, any more than one can truly explain the cause of peptic ulceration, nevertheless this condition is favored by: (1) Utilization of non-absorbable suture material; (2) traumatism by clamps or fingers producing erosions and hematomas; (3) suppuration of the anastomosis by careless suture or trauma; (4) faulty technic; (5) too rapid normal finding; (6) hyperacidity, and (7) suture infection from the upper digestive passages, such as bad teeth, or nose and throat infections.

Symptoms of jejunal ulcer fall into three periods: One a free period of about eighteen months following the operation; then a period with digestive manifestations, such as heaviness, distress, uneasiness, eructations suggesting delays in gastric evacuation; pain and regurgitation suggestive of hyperacidity; and, finally, such complications as jejuno-colic fistulas and abscess of the abdominal wall.

Roentgen-ray signs are those of a deformity in the contour of the stoma, diminution in the size of the stomach, and a tender point over the stoma. Signs of a jejuno-colic fistula are rapid evacuation of the stomach and filling of the transverse colon, or *vice versa*; entrance of an opaque colon enema into the stomach; jejunal dilatation; tenderness over the lesion; irregularity of the stoma and fixation of the lesion.

Escudero² discusses some of the *disturbances associated with gastroenterostomies*. He mentions apparent accidents as due to several varieties of causes; one in which the operation is performed on non-ulcerous cases through an error in diagnosis. In one case cited, operation was unsuccessful, and blood and cerebrospinal fluid studies showed the presence of incipient tabes which induced gastric symptoms. These disappeared after the exhibition of cyanide of mercury. Other apparent troubles were those associated with the ulcer, but in no way ascribable to the gastroenterostomy, such as gastric syphilis, chronic gastritis, nervous dyspepsia, and aërophagia, in which the ulcer was cured but the symptoms referable to those other conditions persisted. Finally, gastric or extragastric disturbances, subsequent to the establishment of the gastroenterostomy, such as those due to gastric arteriosclerosis and abdominal angina, must be mentioned. Actual accidents are due to adhesion formation, plastic peritonitis with obstruction, and superimposed lesions, such as peptic, jejunal or gastro-jejunal ulcers with their complications, perforation, peritonitis, gastro-cutaneous, colic-jejunal and colic-gastric fistula. The frequency of syphilis impressed this author, and he suggests the use of mercury before and after operation.

¹ Paris Chirur., March, 1922, **14**, 137.

² Rev. Assoc. Med. Argentina (Surg. Sect.), Buenos Aires, December, 1921, **34**, 212.

Stevens¹ discusses the *surgical treatment of gastric and duodenal ulcer with the end-results of gastroenterostomy*. Except with repeated hemorrhage or perforation all acute ulcers should be submitted to medical treatment by which, according to the best statistics, about 80 per cent are cured. Repeated hemorrhage, perforation, stenosis, and those cases which have resisted medical treatment, are indications for operation. The internist and surgeon working together in harmony should be able to cure 96 to 97 per cent of all gastric and duodenal ulcers.

Eusterman² discusses the *diagnostic and therapeutic aspects of late sequelæ of gastric surgery*. The article summarizes in a general way the subject of the medical and surgical treatment of peptic ulcer. In the Mayo Clinic failure to achieve cures made 228 secondary operations necessary out of 6402 operations for all types of chronic benign ulcer. There were 4793 posterior gastrojejunostomies alone in this series. Gastro-jejunal or jejunal ulcer necessitated secondary operation in 57 cases. In 27 cases there was a new ulcer, or an ulcer near the site of the old operation. Carcinoma developed on benign ulcer for which gastroenterostomy had been done in 23 cases. In 144 out of 4793 gastroenterostomies, or 3 per cent, a secondary operation had to be performed. Graham reported 88 per cent cures up to 1914. Since that time, about 1800 additional cases have been operated upon with about the same percentage of cure.

The author in this article reviews the relative merits of surgical and medical treatment for ulcer. Consistent medical treatment is often superior to poor surgery; likewise, the failure to institute proper post-operative treatment is responsible for many of the disturbances following operation.

Unquestionably the best interests of the patient are served by intelligent coöperation of physician and surgeon, and we believe that the statistics given by Eusterman enable us to predict, with a reasonable degree of certainty, what will happen to the individual who has a gastroenterostomy performed under the best conditions.

O'Connor³ discussing the subject of *gastroenterostomy* suggests that the patient after operation remain in bed on a rigid milk diet for twenty-eight days, taking an alkaline mixture three times a day. Then he should eat only two meals a day; masticate thoroughly; take in moderation an alcoholic beverage at lunch and dinner but not at other times; rest mind and body one hour after a meal; allow at least a six-hour interval between noonday and evening meals; when feasible, walk in the evening after dinner; sleep in a room with a large open window; and take regular morning exercise.

Studies on the Physiology of Gastroenterostomy. Burget and Steinberg⁴ discuss the question of the physiology of gastroenterostomy. Their studies have to do with the observation of this operation on dogs.

It has been known for a long time that the duodenal juice will regurgi-

¹ Illinois Medical Journal, June, 1922, **41**, 428.

² Journal of the American Medical Association, October 5, 1921, p. 1246.

³ British Medical Journal, February 25, 1922, p. 310.

⁴ American Journal of Physiology, April 1, 1922, No. 2, **60**, 308.

tate in the normal stomach, especially when the acidity was of any pronounced degree. Boldyreff was the one who pointed out this mechanism and a number of observers have since been able to demonstrate it. Morse, for instance, demonstrated it in dogs; Hicks and Visser likewise noted it in the stomachs of dogs after the introduction of 0.5 per cent hydrochloric acid; the Rehfuess and Hawk demonstrated this same phenomena in normal individuals.

In this series of studies the authors examined normal dogs and were able to demonstrate that high acidities were reduced to from 0.1 to 0.2 per cent in seventy-five to ninety minutes after the introduction of acid.

Regarding the question of gastroenterostomy, Paterson claimed that the total acidity was reduced 30 per cent and bile could be demonstrated in 73 per cent of patients who had this operation performed. Lemon found a reduction of the acidity after this operation of 39 per cent total, and 46 per cent free acidity. In this series, it was assumed that the reduction was due to the influx of the alkaline duodenal secretion.

In this series of experiments, it was noted that, after posterior gastroenterostomy, duodenal regurgitation takes place within fifteen minutes after the introduction of 100 to 150 cc of 0.5 per cent hydrochloric acid instead of thirty to forty-five minutes as in the normal stomach, and the acidity is reduced to 0.1 to 0.2 per cent in thirty to forty-five minutes instead of seventy-five to ninety minutes as in the normal stomach. It is generally assumed that the normal regurgitative mechanism is due to peristalsis.

Blood Changes in a Gastrectomized Patient Simulating those of Pernicious Anemia. Hartman.¹ In this case, an individual of fifty-eight years, the operation of total gastrectomy was performed for a movable carcinomatous ulcer on the posterior wall of the stomach. About 1 cm. of the esophagus was removed, and the end of the esophagus was sutured to the lateral wall of the jejunum. A little less than two years after the operation the patient again presented himself to the clinic, and he had grown progressively weaker during the last year and in the last three months, especially, before his last appearance. He complained of some regurgitation after meals, and if this was long continued it resulted in the regurgitation of bile. He was also paler in appearance, and his wife mentioned the fact that at times he was "more yellow." Most interesting was the blood examination which showed hemoglobin which ranged between 53 and 55 per cent; erythrocytes which were between 2,000,000 and 2,280,000; white cells between 2200 and 7600 and the color index constant at 1.2 per cent. The differential count read as follows: Two hundred cells counted; polymorphonuclear neutrophils, 59 per cent; small lymphocytes, 35.5 per cent; large lymphocytes, 5.5 per cent. Slight anisocytosis and poikilocytosis were present. The Ribiere test revealed an increased resistance of the red cells. The blood Wassermann was negative. The blood was classed under Group IV. An analysis of the duodenal contents estimated in Wilbur and Addis units showed an increase in bilirubin, urobilin and urobilinogen. A neurological examina-

¹ American Journal of the Medical Sciences, August, 1921.

tion showed no evidence of cord changes. The pancreatic ferment test showed marked reduction of pancreatic activity.

The interesting point about this case was the possibility that the absolute lack of gastric ferments might have something to do with an incomplete or abnormal food-splitting process, the results which might be hemolytic to the blood or detrimental to the blood forming organs. Pernicious anemia is invariably associated with achylia. It is interesting to note that recurring anemia and weakness were also found in one of Moynihan's cases.

Cancer of the Stomach. Rockey, discussing *cancer of the stomach*, says that 90,000 people in the United States are destroyed by cancer alone every year. One-third of these are due to cancer of the stomach, with 34,293 yearly mortality from that source. Emphasis is laid on the importance of a thorough examination of every individual from the standpoint of chemical, roentgen ray, and all physical means destined to demonstrate the possibility of a lesion. All cancer is curable by complete excision, and none is curable when the patient has passed the surgical possibility of complete excision.

Dume¹ discusses the DIAGNOSIS OF CANCER OF THE STOMACH. In the classical group of cases the loss of appetite, dislike for food, dyspepsia and loss of weight are the initial symptoms. In the group in which carcinoma has been engrafted on an old ulceration there is a history of periodic dyspepsia, becoming more and more severe and often changing in its general character.

Pain in the upper abdomen, or a change in the general character of an old digestive disturbance, nausea and even vomiting aside from acute digestive upsets, or loss of weight—all call for a complete study of the individual. Tumor may or may not be felt. The acidity may remain fairly high but is almost always reduced, and the triad of achylia, pain and dyspepsia in elderly people nearly always spells carcinoma in the upper abdomen. In the evolution of ulcer cases, when occult blood fails to disappear from the stools on careful treatment, it suggests the possibility of malignancy. Pus and blood in the empty stomach suggest the possibility of an ulceration of a malignant process. The reviewer feels, however, that pus and blood are frequently found in older people, owing to the swallowing of infected material from a pyorrhea or post-nasal infection. Furthermore, in these cases roentgen-ray examination shows characteristic defects.

Taylor and Miller,² in an ANALYSIS OF GASTRIC CANCER AND ITS ASSOCIATION WITH PREEXISTING ULCER, discuss the results of their studies of 182 cases of gastric cancer. They found a suggestive history of pre-existing ulceration in only 17 per cent, and they included in this list all those cases that had digestive symptoms other than the usual ulcer syndrome, apart from the digestive disturbances of childhood. This is interesting when it is realized that several years ago another well-known gastro-enterologist was able to demonstrate such a history in only 23 per cent of his rather extensive material.

¹ Nebraska State Medical Journal, May, 1922, 7, 159.

² American Journal of the Medical Sciences, December, 1921.

Some interesting data was obtained on this material. Eighty-five per cent were between forty and sixty-nine years of age; only 2 patients were in the third decade, 1 twenty-four and the other twenty-seven. Pain occurred in 55 per cent and vomiting in 17 per cent. Other symptoms were "stomach trouble or indigestion," loss of weight, belching, a lump in the abdomen, weakness, constipation and pain in the back. While 55 per cent gave pain as the chief complaint, 88.5 per cent stated it was one of the prominent symptoms, and of this number 94.4 per cent complained of pain in the epigastrium; 82 per cent were constipated. Pain in the back was seen in 29 per cent of pyloric cancers, and of all those who complained of pain in the back 80 per cent had involvement of the pylorus. With pyloric cancer the average free and total acid findings were 15.5 and 45, but there was definite retention. When cancer was situated elsewhere figures were low but there was no retention. A positive diagnosis with the roentgen ray was made in 96.8 per cent of cases.

Prentis¹ discusses the INHIBITORY EFFECT OF SECRETIN ON THE FORMATION OF GASTRO-INTESTINAL CANCER. It is its presence in the duodenal mucous membrane that prevents the formation of cancer there; and it is rather significant that there is no secretin present in the esophagus, stomach or large intestine. In other words, cancer is most frequent where this substance is least frequent. The liver is the largest, and the presence of secretin in the portal blood explains the infrequency of primary carcinoma of the liver; and also the fact that primary carcinoma of the pancreas is three times more frequent than primary cancer of the liver. The use of secretin is suggested therapeutically.

Bennett and Dodds² discuss the question of certain conditions associated with deficient secretion in the upper digestive tract. These authors briefly summarize their findings as follows: (1) Complete absence of the gastric HCl, and hence all active gastric ferments, is frequently encountered in healthy persons. (2) A similar condition is frequently seen in dyspepsia subjects. (3) In rare cases an increased amount of mucus is seen, sometimes indicative of a true gastritis, and not infrequently due to pulmonary or nasopharyngeal disturbances. (4) In other rare cases achylia offers delayed emptying of the stomach, and such patients usually show visceroptosis. (5) In a patient who is shown to have pancreatic sclerosis, the fall of alveolar CO₂ tension, which normally occurs after the passage of food through the pylorus, is absent. (6) In patients suffering from pernicious anemia, there is, in addition to a complete achylia gastrica, a marked diminution in the pancreatic fall of alveolar CO₂ tension. (7) Such patients have clinically been shown frequently to have pancreatic insufficiency. (8) Similar pictures of alveolar CO₂ tension and lack of acidity have been found in severe anemia to be due to a secondary blood condition. (9) At least four types of pictures are given by the laboratory examination of gastric cancer. (a) First, a type of extreme pyloric stenosis; (b) a type charac-

¹ Medical Record, April 1, 1922, 101, 542.

² Lancet, June 10, 1922, 1138.

teristic of cachexia; (c) a type of excessive secretion of mucus; and (d) a type difficult to differentiate from benign achylia.

Gastric Juice. METHODS OF MEASURING ACIDITY. Lauz¹ calls attention to the necessity of examining the functional alterations of the secretory mechanism, not alone in ulcer and cancer, but in many of the mild affections of the stomach.

The actual acidity is the measure of the "active" secretion. It measures the number of free hydrogen ions, regardless of the form or derivation of the acid, whether hydrochloric (the most important), lactic, phosphoric, or even acetic, found only in the diseased stomach. It is the actual acidity on which peptic digestion depends, and it is this acidity which measures digestive power. The author claims that titration procedures are not as good as calorimetric procedures for measuring this acidity. The "potential acidity" is the number of hydrogen ions which are not isolated or free, but which are replaceable. They are determined approximately by the difference between the total and the real, or "actual," acidity, as mentioned above. It gives the quantity of bases present capable of entering into combination.

Total acidity is the sum of the two acids, free, or actual, and potential. It is difficult to determine accurately, and varies with a multitude of causes. The author believes the determination of the free hydrogen ion, or "actual," acidity, the most important.

THE VALUE OF FRACTIONAL ANALYSIS of the gastric contents has been questioned by a series of communications; *viz.*, those of Gorham, Wheelom, and Koppleman, who have sought to discredit fractional analysis on the basis that there was a variation in the gastric acidity in the various parts of the stomach.

Gorham² discusses the variation of acid concentration in different portions of the gastric chyme and its relation to clinical methods of gastric analysis. He used a dry test-meal of shredded wheat biscuit and 400 cc of water, after the removal of the fasting contents. The tube was then reintroduced into the stomach forty-five minutes after the administration of the meal and the contents aspirated in 10 cc portions in rapid succession until the stomach was empty, the last portion being obtained after the inflation of the stomach with air, the patient presumably lying supine. These experiments were carried on in 65 cases, and in a few cases successive test-meals were given and the stomach completely emptied in one-, one and a half- and two-hour periods. The author attempts to show in this manner that the different portions of the gastric chyme vary widely in acid concentration, and therefore small samples, such as obtained by fractional analysis, where only a small portion of the contents is obtained for analysis, is not, in the majority of cases, representative of the gastric chyme. He furthermore points out the fact that the sample obtained in this way is dependent entirely on the position of the tip, as well as the particular moment in which the specimen was obtained. He furthermore assumes, without any demonstration to ascertain the fact, that the position of the tip is a constantly

¹ Schw. med. Wehnschr., 1921, **17**, 1057-1066.

² Archives of Internal Medicine, April 15, 1921, p. 435.

changing one, owing to the change in the size and position of the stomach, and presumably, although no evidence is offered, that the shortening and lengthening of the stomach from gastric contraction alters the position of the tip. Furthermore, this author mentions the fact that this phenomenon explains in part the great variety of acid curves obtained by the fractional method. In his conclusions, he mentions (1) the fact that a method of gastric analysis is introduced for determining variations of the acid concentration in different parts of the gastric chyme after a test-meal. (2) That the gastric chyme is not, in the majority of instances, a homogeneous mixture and that different portions may vary markedly. (3) He claims that a small portion removed in that way is not necessarily representative of the gastric contents; and, finally, attention is called to the fact that a physiologic principle, such as was mentioned above; *viz.*, the alteration in the position of the tip, explains in part the great variety of curves obtained by the fractional method.

A second observer, Wheelom,¹ goes into this matter even more thoroughly, in which the results reported are based on 296 gastric sample titrations from 64 normal medical students. In this group of cases, three methods of procedure were employed: (1) The usual one-hour test following the complete removal of the stomach contents at one time. (2) The fractional method in which withdrawal of the contents was made every fifteen minutes following an ingestion of the test-meal. (3) A method recently described by Gorham such as has been mentioned above.

In this series of tests, the 2 slices of bread and 500 cc of water were employed for the meal.

While this series of studies is more complete than that of Gorham, the conclusion which the author reaches is that the acid concentration of the gastric contents is not, in the majority of cases, (19 young men) constant in all parts of the gastric contents at the end of one hour. (2) That the withdrawal of the gastric contents for purposes of determining the acid concentration, the type of the meal, the position of the tube tip and the duodenal regurgitation are factors which militate the acceptance of fractional curves as indicative of the secretory functions of the stomach. In this series of studies, comparisons are made between the various methods of examination.

These columns are no place for a critical reply to these investigations, nevertheless the reviewer feels obligated to point out one or two facts of importance, even though the reply to such criticism will be forthcoming in the future.

The observations of these investigators seem to be based upon the fact that there is a variation of the gastric acidity in the stomach. This idea is not new, nor is the idea that there is lack of homogeneity in the gastric contents new. It is obvious that the homogeneity of the gastric contents will depend largely on the type and nature of the contents, and the duration and character of gastric work. A meal with solids of different kinds will obviously reveal less uniformity than a meal which

¹ Archives of Internal Medicine, November, 1921, 28, 1613.

is largely liquid in character. The fractional tube was devised to meet a need; *viz.*, a method of gastric intubation which was far more pleasant and comfortable than the commonly-accepted tube, and, furthermore, was a method by which a tube could be left in place over long periods, and the characteristics of the gastric contents thoroughly studied. In fact, it was by this tube that these observers were able to demonstrate variations in the character of the gastric contents. These observations are both incomplete and lacking in the very details which they themselves acknowledge. In the first place, they fail to determine accurately the position of the tube. Had they done so, and observed the ordinary precautions, it would have been found that if the tube was passed to a certain point the tip is almost always in the pyloric antrum in the supine or upright position. This has been the experience, not only of the reviewer, but also of other investigators with whom he has been in contact. In the second place, the idea of removing successive fractions of the gastric contents does not reveal the nature of the contents at the present moment of removal. In previous studies we were able to demonstrate marked variations in the gastric acidity during the early periods of digestion, which are commensurate with what we were expecting to find before more or less equilibrium was established. These variations, however, are far less pronounced as digestion proceeds, and the mixture becomes homogeneous. In some of the earliest studies which were made, in the beginning of digestion, removing samples at one-minute intervals, we were able to demonstrate a marked accretion in gastric acidity. Furthermore, other observers were able to demonstrate that while there are some variations in the gastric contents, these variations are of minor importance and do not detract from the main fact, which is that by means of the fractional tube it is possible to gain a fairly good and accurate picture of the evolution of gastric digestion. These authors have in no way been able to demonstrate the falsity of the principle which gastric analysis clearly emphasizes, and that is the fact that gastric digestion is a continually changing cycle.

In communications which we shall present in the future, these criticisms will be fully dealt with, but the reviewer is of the opinion that for a representative study of the evolution of gastric digestion through all its phases, no method offers more possibilities than the commonly accepted method of fractional analysis.

Friedenwald¹ discusses the result of a series of fractional analyses of the gastric contents in 210 cases and covering a wide diversity of clinical conditions.

The conclusions are as follows: (1) By means of fractional analysis we can study the entire cycle of digestion, both as to secretory and motor activity of the stomach. (2) By complete aspiration at any period of digestion, we can obtain definite information regarding the amount of the secretion. (3) In duodenal ulcer, the acidity is usually higher than in any other condition. There is a rapid, prolonged rise followed frequently by a fall and a second rise, although there may be a con-

¹ Southern Medical Journal, September, 1921.

tinuous prolonged rise. The highest acid appears frequently after one hour. Blood is occasionally found, and the rapid evacuation is rare. (4) In gastric ulcer there is no typical curve of gastric acidity, although a fall, followed by a second rise, is not infrequent. Hyperacidity is usually present, although there may be low or normal acidity. The highest acidity appears one hour afterward in most cases. There is usually delayed motility in gastric ulcer. (5) By means of fractional analysis, the acidity in any period of the digestive cycle of ulcer may be noted. (6) The effect of an ulcer cure can be followed by fractional analysis. In about one-half of the cases observed, there was no positive reduction of acidity, even though clinical improvement was noted. (7) In pyloric stenosis there is usually high acidity over the whole period of digestion, with delayed motility. (8) In most cases of carcinoma one finds a typical achylia frequently associated with delayed motility, and a rather high total acidity, with lactic acid and blood. The Wolf-Yung-hans test is positive in these cases, considerable amounts of albumen being present in three-quarters of an hour, and the amount of albumen being markedly increased within one and a half hours. (9) Cases of chronic gastritis present the same characteristics as those usually observed in simple achylia. The total acidity is usually higher, and, in addition, mucus is obtained which is not frequently observed in achylia. The motility of the stomach is often delayed. (10) In gastric syphilis the curves of acidity are similar to those observed in cancer, the total acidity is high and there is a complete achylia. The stomach empties itself rapidly. (11) Fractional analysis of the gastric secretion, according to the Rehfuess method, is extremely important in all cases of achylia gastrica, inasmuch as by means of this method one can readily differentiate true achylia from the spurious form. This differentiation is extremely important, inasmuch as many of the false achylia present a very high hydrochloric acid indication, sometimes even marked hyperacidity. These cases are in reality cases of delayed hyperacidity. In true achylia, hydrochloric acid is absent in every specimen, the total acid is low and there is marked hypermotility. In pernicious anemia one observes the typical features of a true achylia. (12) In nervous gastric effects, one observes a tendency to lower acid and achylia, while in chronic appendicitis hyperacidity is usually observed. (14) There is no pathognomonic curve absolutely distinctive of any gastric lesion.

E. C. Dodds¹ discusses an extremely interesting phase of gastric secretory studies. In this communication it is pointed out that the tension of carbon dioxide in the alveolar air undergoes certain definite changes in response to the amount of the secretion poured out in the stomach, and also a commensurate change from the outpouring of the alkaline pancreatic secretion. Samples of the alveolar air are collected after forcible expiration before breakfast, and the percentage of carbon dioxide determined by an analysis with Haldane's apparatus. The patient is then given a test-meal, and fifteen-minute interval examinations are made both of CO₂ and also the gastric secretion. He found

¹ Lancet, September 17, 1921.

rather characteristic curves for various conditions, and suggests that the results demonstrate the total amount of acid or alkali poured out. In studying the curve the effect of the outpouring of acid, and then the compensatory outpouring of alkali, is noted. This work is very suggestive, and there occurs in a former number of the *International Journal of Gastro-enterology* a similar article. This subject, however, requires thorough investigation, but it is hardly possible that such methods can supplant the actual study of the gastric contents, inasmuch as the determination of gastric acidity is but one of the points to be worked out.

Lockwood and Jacobson,¹ discuss the *significance of successive aspiration of the gastric contents*. According to these authors, the method of fractional analysis has been extensively adapted, and, according to the literature, one almost universally accepted as giving an accurate picture of stomach work throughout all its phases. Doubt, however, is thrown on its value by Gorham, who assumes that, for the method to be correct, each specimen must retain the stomach contents as a whole at that particular time. Wheelom makes the same assumption. Both claim that the gastric contents are not a homogenous mixture. This was shown by aspirating the whole of the contents in portions of 5 to 10 cc and finding a variation in the acid content of the different specimens.

These authors, however, from their observations on 45 cases, came to the following conclusions: (1) Different portions of the stomach contents aspirated in quick succession through a small tube show a moderate variation in physical character and acid contents. (2) The tube tip usually rests near the outlet of the stomach, the patient remaining seated or supine. (3) When small amounts are aspirated at regular intervals, one gets the cycle of events as they occur in the pars media and the pars pylorica. (4) Fractional gastric analysis does, in the majority of cases, give us fairly accurate information on the normal or pathologic physiology of the most important functions, and is our best method of determining food and drug action in the stomach.

Another author, Knapp² discusses the *standardization of the test-meal*. His conclusion is that there is a definite lack of standardization of test-meals, for which there is no evident good reason. The Ewald meal, weighed accurately, is the one suggested. The quantitative type of test-meal is recommended by this author. He gives a list of 18 institutions, and tabulates some important statistics regarding the method of analysis used by those institutions. The different meals vary considerably, although almost all of them consist in some form of carbohydrate and water. In 12 institutions the fasting stomach is examined; in 10 institutions, the fractional method is employed; in 1 institution the single examination is made in thirty minutes; in 8, it is made in forty-five minutes; in 6, it is made in one hour. In 14 cases the entire residuum of the meal is aspirated. In almost every instance phenolphthalein, and Topfer method of analysis, is employed.

Pemberton³ discusses the *diagnostic value of the fractional meal*. This article discusses, in a general way, the question of the analysis of the

¹ New York Medical Journal, June 7, 1922.

² Ibid.

³ British Medical Journal, July 1, 1922, p. 7.

curves, including the rate and nature of secretion which depends upon the amount of mechanic or psychic stimulus which is brought to bare on the gastric mucous membrane, and it can be assumed, as a general rule, that, apart from slight psychic disturbances, these two factors, the rate and the amount of secretion, may be assumed to be the property of the particular stomach which is being examined. Furthermore, the next point is the question of the rate of evacuation, and, finally, the question of the degree of neutralization or dilution brought about by regurgitation from the intestines. Quoting the author, leaving out all account during possible but unknown factors, such as the part played by the vascular system, some sort of general relationship may be formulated between the above factors and the resulting acid concentration of the fluids withdrawn from the stomach. If "C" represents any point on the total acidity curve, and S would represent the gastric secretion, and E would represent the evacuation, and R the degree of intestinal regurgitation, then it would appear that C varies as S and indirectly as E and R. This relation cannot be considered as being in any way exact, although the two associated factors E and R would appear to operate almost at once. It is certain that we reach higher values at the later period. This author mentions six types of curves, and the author is of the opinion that this method of examination is at least admissible as an aid to diagnosis.

Observations on Gastric and Duodenal Motility in Duodenal Obstruction.

In an interesting case of small intestinal obstruction affecting a child, aged seven months, Wheelon¹ demonstrated some interesting facts regarding gastric and duodenal motility. The illness began with vomiting, and after a period of protracted fever, vomiting and some temperature rise, the child was submitted to roentgen-ray examination, where the condition was diagnosed as an obstruction or kink at the level of the ligament of Treitz, at the duodeno-jejunal junction. At operation, however, the obstruction was due to incarceration of the bowel in a peritoneal sac in the lower ilium. In this case evidence is brought forth to support the fact that the acid control of the pylorus is not the only factor in the control of pyloric action. In this case, too, it was demonstrated that, in spite of some difficulty in the egress of material from the duodenum, the stomach was able to fill up the duodenum and even induce marked distention. Beyond a certain point, however, the duodenum regurgitated material back into the stomach. Vomiting unquestionably is associated with duodenal distention.

Relation Between Ulcer of the Duodenum, Appendicitis and Cholelithiasis.

In this discussion, Schutz² recalls the ideas of Moynihan, Rösle and Kelling on the frequency of association of ulcer of the duodenum, appendicitis and cholelithiasis. Opposed to these, the author cites his own observations as well as those of Mayo, Schrijver and Nowak on the rarity of these associations. There is no question of the frequent association of perivesicular affections with those of ulcer of the duodenum; but the association is almost always a contiguous inflammation and not a true

¹ Journal of the American Medical Association, October 29, 1921, p. 1404.

² Wien. klin. Wchnschr., October 6, 1921, p. 484-485.

and spontaneous infection of the biliary passages. More often these perivesicular changes are quiescent and induce no disturbance, but not infrequently they can simulate an attack of biliary colic which lends color to the supposed association. On the other hand, cholelithiasis is much more frequent with women, and duodenal ulcer with men.

As to the relationship between duodenal ulcer and appendicitis, in many instances the appendix, on removal, is anatomically normal, and the removal has little effect on the subjective symptoms. When, however, the appendix is definitely diseased, its removal causes a cessation of all pain.

It is rather remarkable that appendicitis seems to decrease as we know better ulcer of the duodenum. This question is one which requires exact study.

In the reviewer's opinion, there is no doubt that the association does exist at times, but that it is as frequent as we are led to believe from certain publications is hardly within keeping with the facts; and yet the incidence of appendectomy without relief is altogether too large in cases of ulcer of the duodenum.

Physical Characters and Enzymatic Activities of the Duodenal Secretion. McClure, Wetmore, and Reynolds¹ discuss in this communication the characteristics of the duodenal secretion during gastric digestion in normal young men. Emptied on the fasting stomach, the Rehfuß tube was inserted, and the patients examined with the fluoroscopic screen until it was determined that the tip was in the second portion of the duodenum. They were then fed one of five types of meals: (1) 300 cc of a mixture of milk, water, and cottage cheese; (2) 300 cc of 20 per cent cream; (3) 300 cc of 0.5 per cent cooked cornstarch solution in which was dissolved 15 grams of lactose, and (4) 300 cc of tap water. To each meal was added 40 grams of barium sulphate. A fifth type of meal consisted of 40 cc of 20 per cent cream and 10 grams of barium sulphate. The presence of the barium salt permitted fluoroscopy of the stomach and duodenum during the process.

After the subject had ingested one of these meals, he was turned on his right side and a small amount of the duodenal contents aspirated, after which it was obtained by syphonage. The amounts obtained in this manner were never less than several hundred cubic centimeters, and the times varied from two to four hours, depending on the time interval of gastric evacuation. Water left the stomach in from one to one and a half hours; starch and lactose in from one and a half to two and a half hours; the milk and cottage cheese mixture in from three to three and a half hours; the 300 cc cream mixture in from four to five hours, while the 40 cc cream left in about one hour's time.

Duodenal contents collected after the water meal were greenish-yellow the first hour, golden-yellow in the second hour; those of the first hour being slightly viscid, those of the second hour more so. The starch-lactose mixture gave yellowish-brown specimens during the first hour

¹ Journal of the American Medical Association, November 5, 1921, No. 19, **77**, 1468.

and golden-yellow during the second hour. The contents with this meal were somewhat more viscid than those obtained with water. The contents with the milk, water and cottage cheese meal were deeply yellow and more viscid than any of the above-mentioned samples. The 300 cc cream meal gave deep golden-yellow samples, with the exception of the first two hours when they were greenish-yellow. Finally, with the 40 cc cream meal the specimens were greenish-yellow during the first hour, and lemon-yellow during the second hour. The contents with the cream meals were much more viscid than those obtained with any other meal, and these findings suggested that differences in color and viscosity of the duodenal fluids in some way is dependent on the kind of food ingested.

In determining enzyme action, the use of mixtures of disodium phosphate and potassium acid phosphate solutions, whereby the degree of alkalinity necessary to bring about uniformity and proportionality of enzyme action had been obtained. In these studied, protein activity was ascertained by allowing the duodenal contents to act upon a soluble solution of casein. The amount of digestion which occurs is estimated by an adaptation of the method of Folin and Wu for the determination of non-protein nitrogen. Amylase activity is estimated by the action of the duodenal contents on starch solution. The amount of sugar formed is estimated by the method of Folin and Wu for the determination of sugar in the blood. Lipolytic activity is estimated by the action of the duodenal contents on a true emulsion of cotton-seed oil, and is represented as the number of cubic centimeters of tenth normal sodium hydroxide necessary to neutralize the degree of acidity developed.

The degree of acidity, that is to say the hydrogen-ion concentration of the duodenal contents derived from the various types of meals, was also determined.

Duodenal Diverticula. Andrews,¹ in a short but interesting summary, reviews the literature of duodenal diverticula. An analysis of Case's papers on this subject has been made in these columns, and it will be recalled that very extensive studies were then reported regarding diverticula through the entire length of the digestive tract. Andrews point out the fact that our knowledge of duodenal diverticula really belongs to two periods, one the mortuary period from 1710-1910, when in reality the condition was viewed as an interesting deformity on the mortuary table—and a second (or roentgen-ray period) in which the clinico-pathologic evidence likewise markedly increased. A third, or coming period, is one in which we may view the evolution of the operative treatment for this condition; and where broad problems of etiology, its association with ulcer pathology and other similar problems must be worked out.

After a brief but comprehensive review of the literature, the author discusses several phases of the subject. It was noted, for instance, that duodenal diverticula belonged to the acquired, rather than the con-

¹ Journal of the American Medical Association, October 22, 1921, No. 17, 77, 1309.

genital, deformities, especially inasmuch as they belong to the latter half of life; although Shaw reported one case in a new-born infant. They were usually single and were most often found near the papilla of Vater. They were most commonly 0.5 to 3 cm. in diameter. Frequently they were covered over with the intact duodenal mucosa. The direction has been various—forward, backward, upward or downward.

In the discussion of etiology, the weak points in the duodenal wall are mentioned, such as the insertion of the vessels, especially the veins, which constitutes a point of lessened resistance. Again, inflammatory disease and round ulcer may weaken the intestinal walls. One cannot ignore the frequency of these manifestations at the head of the pancreas, where, according to Kath, the musculature is weakened, possibly by the duct and large vessels penetrating its wall. In Linsmayer's 1367 necropsies, 45 cases, or 3 per cent, were found; and Buschi noted 2 per cent (or a total of 73 cases), 54 of which showed clinical symptoms. Case reported 6847 examinations with 85 cases, some 1.2 per cent discovered by roentgen-ray examination. In Andrews studies of roentgen-ray examinations of 2200 stomach cases, 300, or 14 per cent showed deformity of the duodenal canal, and only 26, or 1.2 per cent resembled diverticula.

These deformities range all the way from slight kinks or angulation of the tube, caused by dragging or outside pressure, to total obliteration. The author makes the statement—which we believe to be of great importance—that for the surgeon and internist “no laboratory report and no roentgenogram can teach him as much as viewing the moving, living picture with his own eyes.”

Intubation and Visualization of the Duodenum in Suspected Lesions of the Pylorus, Duodenum and Gall-bladder. In this communication Palefski¹ seeks to determine whether defective filling of the duodenum is due to ulcer, pericholecystic adhesions, pressure from neighboring organs, or caused reflexly from the intestines and other abdominal organs. This question is one which has puzzled every gastro-enterologist, and is of paramount importance in the diagnosis of upper right quadrant affections. The author quotes Lockwood who says, “over four-fifths of the duodenal ulcers diagnosed by the roentgen ray have turned out to be nothing more than chronic appendicitis.”

(The reviewer considers this statement altogether exaggerated, and suggests that an expert opinion of duodenal ulcer, when the lesion is well-defined, is ulcer in over 90 per cent of cases.) In fact Charles Mayo informed the reviewer that Carman's diagnosis of ulcer of the duodenum was right in 96 per cent of cases.

Palefski proposes to study this subject from the two-fold standpoint of duodenal intubation and fluoroscopic examinations. By means of intubation, the examination of the duodenal secretion for its physical, chemical, microscopic and bacteriologic properties is made. A change in the normal color and transparency is noted, the persistent presence of blood

¹ American Journal of the Medical Sciences, 1922, **163**, 385.

is ascertained, an increase in mucin epithelial cells, or bacteria signifying inflammation of the duodenum or biliary passages, is noted.

Palefski passes the tube into the duodenum, aspirating samples, and then injects a barium suspension, takes exposures and observes the condition of affairs. Prepyloric ulcers and adhesions frequently delay the passage of the duodenal tube. The author says that he has seen fairly large lesions of the cap which showed no roentgen evidence whatsoever. On the other hand, defective filling of the duodenum is, in his experience, less frequently due to duodenal ulcer than to periduodenal cholecystic adhesions. A case with high gastric acidity one hour after a meal, blood in the duodenal contents, delayed gastric evacuation and a normal horseshoe course of the duodenal tube, may be safely regarded as ulcer of the duodenum, whether or not there is defective filling of the duodenum.

The point which the reviewer mentioned in one of his communications, namely, the simultaneous appearance of bile and blood in the gastric contents, Palefski holds to be due to the fact that the tip of the tube has gone into the duodenum. This is not always the case, however.

A case with gastric symptoms showing tenderness in the right hypochondrium, normal or subnormal gastric acidity, delayed gastric evacuation after a mixed meal, a distorted course of the duodenal tube with, or without, defective filling of the cap, may safely be regarded as chronic cholecystic adhesions. Most of these cases show gastric hypermotility six hours after an opaque meal, turbidity, increased mucin, epithelia and bacteria in the duodenal juice, and there is usually a history of constipation. Regarding duodenal intubation after gastroenterostomy; the duodenal tube is allowed to pass through the anastomosis and in perijejunal adhesions the course of the jejunum is distorted and twisted.

Non-suppurative Amœbic Hepatitis. Three forms of non-suppurative amœbic hepatitis are described by Paisseau.¹ Acute abortive amœbic hepatitis, chronic amœbic hepatitis, and amœbic cirrhosis.

The acute abortive form studied by Chauffard and Francon resembles abscess, but all the symptoms disappear after the exhibition of emetine. Ordinarily, the response to medication is rapid. Chronic amœbic hepatitis is characterized by its subdiaphragmatic location, hepatic pain more diffuse than that of abscess, pain referred to the right shoulder, often a dry cough and not infrequently a pleuro-pulmonary reaction. The liver is not much enlarged.

The dysenteric exacerbations do not always coincide with the hepatic exacerbations, although there is more or less constant diarrhea. These patients, anemic and emaciated, have the appearance of chronic malaria. The differential diagnosis must be made from hepatic congestion, pleuro-pulmonary affections and, finally, malaria. The search for cysts in the stools is often negative, but it is the rapid response to emetine which leaves no doubt of the diagnosis.

Regarding the amœbic cirrhosis form, there is little doubt that this exists and may be distinguished from other forms of cirrhosis by its response to emetine.

¹ Paris Medical, 1921, No. 14.

LIVER.

Regarding the question of liver disease, a number of contributions have occurred on the question of **functional testing of the liver**. The difficulties in this line are due to the fact that various functions of the liver may be impaired, and, again, there may be only a partial functional disturbance. Furthermore, certain organic diseases of the liver, attacking only limited parts of the parenchyma, may attain considerable size before any noteworthy change is apparent in hepatic function. Retzlaff¹ discusses the various methods for testing liver function. Regarding the glycogenic function, considerable normal variations may occur in the blood-sugar on the one hand; while, on the other hand, abnormally diffuse inflammation, or even chronic disease of the liver, may occur with a normal blood-sugar. Certainly diminished glucose tolerance is not necessarily a sign of parenchymatous injury. Increased levulose and galactose excretion are more likely to point to liver injury. A positive finding usually indicates diffuse liver injury, while circumscribed processes, like those due to carcinoma, are usually negative in their effects. The urea function is often apparently unaffected, even in severe injuries, although Hetenyi has shown that the synthesis of ammonia salts into urea occurs much more slowly with the diseased liver. The administration of amino-acids with increased excretion in the urine is found in syphilitic, fatty and cirrhotic livers; while increased amino-acid excretion after hydrazin sulphate also indicates disturbance of the liver. An increase in blood-nitrogen is also a bad sign in liver injury. The other methods of testing liver function are discussed. The question of icterus naturally brings up the discussion as to whether the liver is necessary to the production of icterus. Certainly, bilirubin can be developed from blood pigments. The presence of both bilirubin and bile acids should be sought in the urine. The ultramicroscopic demonstration of "hemokonies," or fat bodies, one-half an hour after the ingestion of fat is likewise important. In the diminution or absence of bile acids there are no hemokonies in the circulating blood. The diazo reaction gives varying results, depending on whether the reagent is added to the serum in an alcoholic solution (such a reaction is due to icterus caused by obstruction) or whether it is added to the serum in aqueous solution; the latter reaction being seen in normal blood and in hemolytic icterus.

The duodenal secretion is examined for bile acids, pigment, cholesterol and urobilinogen. Increased pigment may be found in icterus owing to increased blood disintegration, but is absent in hepatic icterus if secretion of bile is lessened. Many points influence the cholesterol content. A negative urobilinogen test definitely rules out heterogenic bile-duct infection. The author mentions the fact that peptone or magnesium sulphate give pure bile, but does not believe that gall-bladder bile can be obtained without liver bile; furthermore, the results after cholecystectomy seem to contradict the value of this test. He is not

¹ Berlin klin. Wehnschr., April 22, 1922, 1, 850.

much impressed with the value of the alimentary urobilinogenuria test, as the tolerance varies widely, even with normal people. The Widal "hemoclastic crises" test, based on the observation that intravenous peptone injections cause vascular crises with leukopenia and reduction of blood-pressure and blood-coagulability, is suggestive but is not confined to peptone. In fact leukopenia after administration of food in an adult generally indicates liver injury. The Widal test, as commonly performed, consists in the administration of 200 cc of milk, which produces in subjects suffering with hepatic disease an appreciable leukopenia instead of the normal digestive leukocytosis.

Dresel and Lewy¹ observed the same result with 50 gm. of cane sugar. These authors found a sudden marked diminution, especially of the lymphocytes, in paralysis agitans.

Mauriac² questions the fact as to whether leukopenia alone is evidence of digestive hemoclasia in hepatic insufficiency. Even normally there is considerable variation, as much as 5000 in the leukocyte count.

Roth and Hetenyi³ did not observe these crises, characterized by leukopenia and a fall in blood-pressure, in patients without liver disease except in two cases of asthma. Analogy is suggested between digestive hemoclasia and anaphylaxis, but the former occurs without symptoms and may be due to any form of protein, while anaphylaxis can only be produced with specific proteins. These authors do not doubt the association of digestive hemoclasia with liver function, but feel that its positive significance is very much overestimated while a negative outcome does not rule out liver disease.

Meyer-Estorf⁴ also discusses the question of hemoclasia. The test is performed with 200 cc of milk, given on an empty stomach after the patient has had a leukocyte count. Another count is made in twenty minutes. A reduction in leukocytes, and particularly in the neutrophilic leukocytes, is noted. The author believes that the degree of leukopenia, on the whole, parallels the liver injury. But there are a group of cases in which there is icterus with leukopenia, a digestive leukocytosis and green p-dimethylamidobenzaldehyd reaction.

Lepehne,⁵ in discussing functional liver testing, discusses the chromo-diagnosis with indigo-carmin, the bile acids in the duodenal contents and the urine, and Falta's test for urobilinogenuria. After the administration of indigo-carmin intravenously, usually within thirty-five minutes, the bile suddenly turns green, and this continues for an hour or more. In catarrhal jaundice, and icterus from cholangitis, no indigo is found in the bile, but on resolution it reappears. The method is not, however, very satisfactory; it resembles the tetrachtophthalein test which Aaron, and others, studied with the duodenal tube.

Regarding bile acids; the use of the sulphur test with normal urine and normal duodenal contents is always negative. This is not the case with icterus. An interesting case of cholelithiasis was presented

¹ Ztschr. f. d. ges. Med., January 29, 1922, **26**, 87.

² Jour. de méd. de Bordeaux, February 10, 1922, **94**, 83.

³ Berlin. klin. Wehnschr., May 20, 1922, **1**, 1046.

⁴ Klin. Wehnschr., April 29, 1922, **1**, 890.

⁵ München. med. Wehnschr., March 10, 1922, **69**, 343.

in which bile gave low acid findings, and urine was positive for bile acids. Four days later it disappeared from the urine and was increased in the bile.

Regarding the urobilinogenuria: Falta, Högler and Knoblock claim that a dose of 3 gm. of dried ox bile produces alimentary urobilinogenuria in persons affected by disease of the liver. Lepehne found this test unreliable. He also found considerable daily variation in spontaneous urobilinogenuria. It may be due to an increased flow of bile after the noonday meal. In Falta's test, the powder should be given in the morning and the examination of the urine should be made at 3 P.M., as the morning urine of some individuals with hepatic disease may be negative.

Biscons and Rouzard¹ discussed the modifications of the serum in hepatic disease. This study is based on 274 cases. The blood was obtained by venous puncture every morning after breakfast and included tests for cholesterol, cholemia, glycemia, blood-urea and the urea secretion constant. It was noted that when the disturbance was due to an extra-hepatic factor, such as hemolytic icterus or obstructive icterus, cholesterolemia and bilirubinemia appeared to be modified only in the beginning. If, however, the trouble persisted for some time, and the hepatic cells be involved, then azotemia and glycemia show modifications. In hepatic congestion, with little alteration of the liver parenchyma, blood nitrogen is increased; in the degenerations and cirrhosis, urea is decreased, but of course in interpreting these findings it is essential to consider the "renal factor." A measurement of renal permeability will enable one then to determine the "urea secretion constant." In cholelithiasis hypercholesterinemia (unaccompanied by any marked increase in bilirubinemia) was observed. The reverse is true in hemolytic icterus, where hyperbilirubinemia was observed without an increase in blood cholesterol.

The diazo reaction as a test for bilirubin in the blood was mentioned above. Several years ago, van den Bergh, and others, found that the bilirubin in the bile gives the diazo reaction immediately, without the addition of alcohol. This was in direct contrast to the bilirubin obtained from gall stones which requires alcohol. These observers then showed that the blood of normal persons gave the diazo reaction without alcohol after a short time. It begins in about thirty seconds and continues to increase. The blood of obstructive jaundice, however, gives the reaction immediately, without the addition of alcohol. This was called the "prompt direct reaction." It was noted that there were really two phases; one an immediate and distinct change, and the other becoming more marked after a few minutes. This enabled van den Bergh to divide the result into two forms; one in which the bile passed through the liver cells and reached the blood by absorption from the bile passages (obstruction type) producing a prompt reaction; and the other the bilirubin formed outside the liver producing the retarded direct reaction.

Meyer and Knupffer² studied the influence of food absorption on blood

¹ Rev. de Med., Paris, February, 1922, **39**, 91.

² Deutsch. Arch. f. klin. Med., February 21, 1922, **138**, 321.

bilirubin, and found a diminution of blood bilirubin to amount to 30 per cent of the original amount.

The Use of the van den Bergh Test in the Differentiation of Obstructive from other Types of Jaundice. J. W. McNee¹ gives a short account of the van den Bergh test, which, because of its importance, I quote verbatim. At a recent meeting of the Association of Physicians of Great Britain and Ireland, held in Oxford, Professor Hijmans van den Bergh, of Groningen, gave a short account of his important work on the presence of bile pigment (bilirubin) in the blood-serum under normal and pathologic circumstances. In doing so, he made reference to the test for bilirubin in serum and other albuminous fluids which is now prominently associated with his name. I have made use of this test in the wards and in experimental work for some months, and the results obtained have, up to the present, fully realized expectations. It was intended to wait until a much larger series of observations had been carried out, but since none of the work of van den Bergh has so far been published in English, the writer has been asked to make some of the main facts accessible at once, leaving the fuller account for subsequent publication. It must, therefore, be understood that the conclusions reached in this short paper cannot be regarded as final, unless confirmed elsewhere or by future work on the subject.

"The first account of the work of Hijmans van den Bergh on the presence of bile pigment in serum appeared in 1913, and a full description of his observations has been collected in a monograph entitled *Die Gallenfarbstoffe im Blute*, published in 1918. More recently (June, 1921) a short summary of the main methods and facts appeared in the *Presse Médicale*.

"Confirmation of some of the chief results claimed by van den Bergh has already been given in Germany by Lepehne (1921), and Rosenthal and Holzer (1921).

"The clinical application of the test in the differentiation of various types of jaundice will be dealt with here alone, although this is merely a small part of the ground which has been covered by van den Bergh. The important observations which are more concerned with experimental work on diseases of the liver, and with the occurrence of latent jaundice under conditions in which icterus has not hitherto been recognized to exist, must be omitted. It is already certain, however, that future research work on hepatic disorders must be greatly influenced by the application of the knowledge made available by van den Bergh's methods.

"The chief clinical value of the test is that by its use jaundice due to obstruction of the main bile ducts by carcinoma, hepatic cirrhosis, obstruction in the portal fissure, or gall stone in the common bile-duct, can be clearly differentiated from jaundice of hemolytic origin or due to functional derangement of the liver cells. In this latter category are now included the various forms of hemolytic and acholuric jaundice;

¹ British Medical Journal, May 6, 1922, p. 716.

and also functional jaundice, such as catarrhal jaundice, toxic jaundice in infective diseases (typhoid fever, pneumonia), icterus neonatorum, etc. It is perhaps not yet generally accepted, except by those who have followed closely the work on hepatic disorders published in recent years, that all modern work strengthens more and more the view that a true hemolytic icterus, apart from the liver, does occur, and also that "catarrhal jaundice" depends on a hepatitis with functional derangement of the liver and not on an obstruction to the bile ducts. The newer methods of van den Bergh throw further light on the question from a new angle, and entirely support both the occurrence of a functional icterus apart from biliary obstruction, and of a hemolytic icterus with which the liver itself is not concerned.

"The value of van den Bergh's test in the differentiation of obstructive, from what may be termed functional and hemolytic, jaundice is illustrated by a few chosen reports of cases given at the end of this short communication.

"Mechanism and Technic of the Test. Hijmans van den Bergh began his work faced with a difficulty which has confronted all who have worked chemically or experimentally on the different forms of jaundice—namely, the want of a delicate and trustworthy test for small amounts of bile pigment in an albuminous fluid such as blood serum. The tests hitherto employed, such as the Gmelin and Huppert tests, with their various modifications, have many disadvantages (especially in albuminous fluids) and are, besides, far from delicate for quantitative estimations.

Van den Bergh has applied, for his purpose, the so-called "diazo reaction," first described by Ehrlich, who found that bilirubin, when dissolved in chloroform or alcohol, gives with diazonium salts a reddish color in neutral solutions and a bluish color in acid solutions. Making use of this reaction to detect the presence of bilirubin in blood-serum, van den Bergh and Snapper found that it gives extraordinarily delicate and certain results. They observed, for example, that every normal serum contains bilirubin in a dilution of from 1 to 400,000 to 1 in 250,000. Such a dilution in human serum is readily detected by the diazo test. They found further, after much observation, that no other substance likely to be present will give the reaction, and they have never detected any other substance in a human serum, except bilirubin, which has given a positive result. Biliverdin does not react to the test. It is to be noted also that lutein, which in certain cases (diabetes, etc.) may deeply color human blood serum and even give the appearance of jaundice to the skin, does not give the reaction.

"Technic of the Test. For the test, an ordinarily carried out, about 3 cm. of serum may be required, although less will suffice after some practice has been obtained. The blood is taken from a vein in the usual way into a dry test-tube, allowed to clot, and the separated serum is then removed by a pipette. It is best to begin to practise the test on a case of fairly intense icterus.

"Apparatus and Reagents Required:

"1. A few test-tubes of ordinary size.

"2. Freshly prepared Ehrlich's diazo reagent. This consists of two

solutions, each of which keeps well, but the mixture of the two must only be made immediately prior to the test. The two solutions are made up in the following proportions:

"A. Sulphanilic acid	1 cc.
Concentrated hydrochloric acid	15 cc.
Distilled water	1000 cc.
"B. Sodium nitrite	0.5 gram
Distilled water	100 cc.

"The diazo reagent consists of a mixture of these two solutions in the proportion of 25 cm. of solution A to 0.75 cm. of solution B.

"3. A graduated 1 cc. pipette.

"4. Absolute alcohol (96 per cent).

"5. A centrifuge and centrifuge tubes.

"The test is then carried out as follows: To 1 cc. of the serum, in a small test-tube, van der Bergh adds 0.25 cc. of freshly prepared diazo reagent. (Lepehne, and the writer, have found that better results are frequently obtained by adding 1 cc. of the reagent. One of three events may now occur:

"1. An Immediate (Direct) Reaction. This begins instantly and is maximal in ten to thirty seconds. The color reaction obtained is a bluish-violet, of intensity depending on the amount of bilirubin present.

"2. A Delayed Reaction. This begins only after one to fifteen minutes, or even longer, and consists in the development of a reddish coloration, which gradually deepens and becomes more violet. (It will be seen later that this reaction is not made use of further, being replaced by the so-called indirect reaction or test—*vide infra*.)

"*Interpretation.* If the reaction is immediate or direct, an obstructive jaundice is indicated.

"If a direct or immediate reaction is not obtained, proceed as follows: To 1 cc. of serum add 2 cc. of 96 per cent alcohol. The mixture is made in a centrifuge tube, which is then centrifugalized until all the albuminous precipitate has sunk to the bottom to leave a clear yellowish supernatant fluid. To 1 cc. of this supernatant fluid add 0.5 cc. of alcohol and 0.25 cc. of Ehrlich's diazo reagent. (The reason for the addition of 0.5 cc. of alcohol is to get a proper dilution for the quantitative test, referred to below, and may be omitted where that test is not being carried out.) A violet-red color is then obtained if bilirubin be present, which is of maximal intensity almost at once.

"Where no direct reaction has been given, but a perfect indirect reaction after alcohol precipitation, then the jaundice can be inferred to be either hemolytic in origin or dependent on some functional derangement of the liver cells without obstruction.

"It should be mentioned that all serums which give a direct reaction will give, in addition, an indirect reaction, but the converse is not, of course, true.

"By these two simple tests, therefore, a distinction can be drawn between icterus due to obstruction of the main bile ducts from gall

stones, tumor, hepatic cirrhosis, etc., and an icterus of hemolytic, infective or functional origin.

"What is the mechanism of the test, and how is it that the bilirubin present in the serum in obstructive jaundice reacts to the diazo reagent quite differently from the bilirubin in hemolytic, catarrhal, and other forms of jaundice?

"It appears to depend on the fact that the bilirubin differs molecularly in the two conditions, and, without going deeply into theoretical considerations here, van den Bergh suggests that in the case of bilirubin giving the indirect test only, the pigment has been in some way bound to albuminoid substances in the serum, and the union is only broken down by time or by alcoholic precipitation. The reader must be referred to the original papers for further consideration of this point.

"Taking this short explanation for granted, the rationale of the biphasic reaction becomes intelligible. It would appear to depend on the presence of both types of bilirubin, in different proportions, in the same serum. If the first variety predominates, the reaction might be described as biphasic direct, and the other as biphasic indirect. The occurrence of the biphasic reaction is fortunately not very common, but, until much further experience with the test has been gained, it is best for the moment to draw no absolute conclusion in a case giving such a result. The writer is finding such cases of great interest at present, and it is already evident that in, for example, cardiac valvular disease with failure, back pressure and hepatic enlargement, the icterus which sometimes occurs may be at first functional and later obstructive in type as the hepatic enlargement increases, the bilirubin showing a gradual transition through a biphasic stage with the test.

"*Application of the Test for the Quantitative Estimation of Bile in Serum.* Although the simple test as described above will probably be the first to be commonly used clinically, it is an obvious advantage to be able to estimate the increase or decrease of bile pigment in the blood serum, especially in cases of obstructive jaundice. This may have importance, for example, in cases of suspected carcinoma of the liver, or in the recognition of the exit of a gall stone from the common bile-duct. It is, of course, well known that the icteric tint of the skin changes comparatively slowly. It has also an importance in the study of various forms of "latent icterus," such as dealt with in a later communication.

"The so-called indirect test of van den Bergh, which, as has been stated, is given by all forms of icterus whether obstructive or non-obstructive, lends itself easily to a quantitative estimation of bilirubin by a colorimetric method. For full details of the method, the original papers should be consulted, but the main principles may be briefly given here. At first, van den Bergh made use of chemically pure bilirubin to prepare a solution for comparison, but he was able soon to replace this with an artificial standard solution giving a color suitable for comparison. This solution, moreover, is made up in a strength which can give a definite reading in "units" of bilirubin. The artificial solution consists of iron sulphocyanide dissolved in ether, in a concentration of

1 in 32,000 normal. This solution is of a color which corresponds exactly with that of azo-bilirubin (as produced in the "indirect test") of 1 in 200,000 the quantity found to be the average amount in the serum of a healthy individual. An indirect reaction giving a color exactly corresponding to this standard is taken as indicative of "1 unit" of bilirubin.

"The Solution of Sulphocyanide. The standard solution of iron sulphocyanide is prepared as follows:

"Dissolve 0.1508 gram of ammonium iron-alum in 50 cc. concentrated HCl, and add water to 250 cc. This gives dilution of 1 in 8000 normal, which will keep for about six months.

"To 3 cc. of this solution add an equal volume of 20 per-cent potassium sulphocyanide and 12 cc. of ether. Shake well, and when all the reddish color has passed into the ether transfer the ether carefully, either into a colorimeter, or other comparative tube. This solution is in a concentration of 1 in 32,000 normal, and must be prepared freshly each day a test (or tests) is made.

"I have made use of the simple Autenrieth-Funk colorimeter for the quantitative estimation, but any form of colorimeter is, of course, applicable. For rough clinical use, dilution of the fluid obtained in the indirect test may be made in test-tubes of equal caliber, and reasonably accurate comparative results obtained. It should be pointed out that, even with the complete technic of van den Bergh, the results are of an accuracy which is adequate for clinical purposes only. There are various fallacies which prevent a completely accurate estimation of the whole of the bilirubin present in any serum. One of the chief of these depends on the fact that some bile pigment is always carried down in the albuminous precipitate when alcohol is added. The amount, however, is always small, and is greater in cases of obstructive than non-obstructive icterus.

"*Report of Cases.* Case 1. Female. History of three attacks of jaundice, with vomiting and epigastric pain, within a period of a few months. Stools clay-colored. Roentgen-ray examination showed two shadows at the level of the twelfth rib, to the right of the middle line, but deeply back in the body. There was doubt as to what these shadows were—biliary calculi, renal calculi, or calcified glands. On the clinical features of the case a diagnosis of gall stone blocking the common bile duct was made.

"On applying the van den Bergh test, the following result was obtained:

"Direct test	Negative
Indirect test	Positive (3 units of bilirubin).

"Exploratory laparotomy was performed; the gall-bladder and bile ducts were normal, and patent throughout. The liver was not enlarged, but icteric in color. The diagnosis was changed to catarrhal jaundice, and the patient made a straightforward recovery.

"Case 2. Female. This patient, a nurse in a fever hospital, had been previously admitted for jaundice, which was said to have followed a febrile illness of some weeks duration. Typhoid was at first suspected,

but the Widal reactions for the enteric group of fevers were negative. The jaundice passed off, but the patient was readmitted for a second attack, accompanied by pain in the right hypochondrium. The stools were light colored. A diagnosis of gall stones was made.

"The results of the van den Bergh test was as follows:

"Direct test	Negative
Indirect test	Positive (4½ units of bilirubin).

"The abdomen was opened, but the gall-bladder and bile-ducts were found to be normal. The patient quickly recovered, and the jaundice passed off.

"Case 3. Female. History of several attacks of severe pain in the right hypochondrium. Never jaundiced until one week before admission. Jaundice of moderate degree. Cholecystitis was the diagnosis regarded as probable.

"The van den Bergh test gave the following results:

"Direct test	Positive
Indirect test	4 units of bilirubin.

"At operation, the gall-bladder was found to be much contracted and embedded in dense adhesions passing along the portal fissure. One large stone was removed from the gall-bladder, but examination of the common bile-duct was almost impossible owing to the dense adhesions. A leak unfortunately occurred from the septic gall-bladder, and fatal peritonitis followed. At the necropsy, the gall-bladder was found to be greatly contracted and strictured. The common bile-duct was embedded in dense adhesions, but no stones were found.

"Case 4. Male. History of jaundice of three weeks' duration; loss of weight; stools light colored. Nothing could be made out by palpation of the abdomen.

The van den Bergh test resulted as follows:

"Direct test	Positive
Indirect test	12 units of bilirubin.

"At operation, a carcinoma of the head of the pancreas was found obstructing the ampulla of Vater."

The Use of Levulose as a Test for Hepatic Insufficiency. Spence and Brett.¹ This is a study in the effect of levulose on blood-sugar in sub-normal and also pathologic cases, including several cases of salvarsan jaundice and several other forms of liver disease. The conclusion of these authors was that a valuable indication of the efficiency of the liver can be obtained by estimating the changes in blood-sugar concentration which follow the ingestion of levulose. In healthy adults with normal liver efficiency, a dose of 50 grams of levulose will produce no appreciable rise in blood-sugar. In subjects with diminished liver efficiency, a definite rise in blood-sugar will result from the ingestion

¹ Lancet, December 31, 1921, 1362.

of levulose. The height and length of the blood-sugar curve which portrays this rise will be in proportion to the degree of liver inefficiency which is present. The dose affords a means of estimating the degree of liver damage in cases of toxic, salvarsan hepatitis and other diseases of the liver. The kidney threshold for levulose is lower than that for glucose and varies in different individuals, and it is this inconstancy of the threshold for levulose which renders the old method for testing liver efficiency by urinary examination inaccurate.

Enriquez, Binet and Gaston Durand¹ discuss **gastric symptoms associated with biliary lithiasis**. They are apparently of two varieties; one which is found immediately after the meal, and the other which occurs six to eight hours later. The delayed type indicates reflex pyloric cramps and often develops into paroxysmal gastric crisis. Biliary colic of course is sudden and acute in onset.

In noting these forms of gastric manifestations, emphasis must be placed on the general history of the patient, the antecedents of gout, gravel, migraine, or cholemia in either the patient's history or his antecedents. The time at which the attacks occur, their frequency, and the condition of the bowels should also be noted. Many of these cases show nausea in the morning and dizziness in the evening, sensations of heaviness and even cold sweats. This sick feeling disappears after breakfast to return later and not disappear entirely until after the noonday meal.

Gastro-vesicular attacks are usually more painful than ulcer crises, and there is often a slight rise in temperature and bile pigments in the urine. The diagnosis should be made by gastric analysis, roentgen-ray studies, and the demonstration of pericholecystitic adhesions.

Biliary lithiasis is more frequent in men than women, and these cases are particularly susceptible to physical or nervous shocks or to a diet rich in fats.

That the autonomic nervous system plays an important role in the formation of many digestive syndromes is unquestioned. In many instances these nervous phenomena have been assumed to be reflex, or frequently hyperirritable from endocrine imbalance.

Loeper, Debray and Forestier² discuss the role of the pneumogastric in nervous dyspepsia. These authors found, after slight irritation of the gastric mucous membrane of the dog, if a poison, like formol, is injected into the stomach, the formol, when sought for by chemical tests, can be found in the trunk of the vagus. If a toxin, like tetanus toxin, is injected into the nerve trunk of the guinea-pig, it appears in the central trunk of the vagus. These experiments would indicate reabsorption of the toxins and poisons by the vagus, and it is likely that medicaments, as well as the products of abnormal fermentation and putrefaction, would affect these nerves in the same way. These toxic products apparently travel to the bulb. Peptone sometimes, after absorption, tends to localize in the bulb. These studies, as well as

¹ Presse Medicale, July 9, 1921.

² Progress Medicale, August 27, 1921.

others of a somewhat similar nature which have appeared from time to time, are suggestive of a new field.

The Action of Various Salts and other Substances on the Liver After Their Introduction into the Duodenum. Einhorn¹ discusses the question of the effect of various salts on the liver after the introduction of these salts into the duodenum. He takes exception to the assumption of Lyon that magnesium sulphate introduced into the duodenum produces a dark-colored bile which is real gall-bladder bile. Einhorn claims that the dark bile does not appear to be the real gall-bladder bile for the following reasons:

1. The color change following the introduction of Epsom salts is not an abrupt one.

2. If Epsom salts produced an evacuation of gall-bladder bile, then the same colored bile should appear when any strength of Epsom salts is injected. This, however, is not the case according to Einhorn. The stronger the magnesium sulphate solution, the darker the color and the higher the specific gravity of the bile, indicating the Epsom salts has a direct influence on the bile itself.

3. A great many other solutions such as sulphate of soda, bicarbonate of soda, and others, have exactly the same effect on the color reaction, which, according to this author, accounts for the effect of these ingredients on the liver.

4. After administering the magnesium sulphate test, an immediate repetition of the test frequently provokes a reiteration of the bile reaction with its entire series of color plays. If the dark bile were gall-bladder bile, the reaction could not take place anew since the gall-bladder had emptied its contents.

5. Patients whose gall-bladders have been removed will give similar reactions after Epsom salts installation, clearly showing that the gall-bladder of such can have nothing to do with the phenomena of color changes in the bile.

The author, in this communication, used a number of substances besides magnesium sulphate, sodium sulphate, sodium citrate, magnesium citrate, bicarbonate of soda, chloride of sodium, calomel, mercurchrome and many other substances, and the method used was the same as the one which he used on the previous occasion; *viz.*, installing a 60 cc solution of the desired salt or some other ingredient into the duodenum at blood temperature, and the siphoning it back by gravity. In this report are given detailed descriptions of the findings in these cases. He, furthermore, asserts that apparently all substances producing dark bile, do it whether the gall-bladder is present or not, and it is therefore evident, according to this author, that the gall-bladder has nothing to do with this phenomena. This author, furthermore, points out the fact that at operation with the duodenal tube in place two important points were ascertained. Magnesium sulphate, when given through the tube, after waiting five to ten minutes showed no dark bile, and the gall-bladder which was exposed and constantly observed, did not show contraction.

¹ New York Medical Journal, September 27, 1921, p. 262.

From Einhorn's observations, he is of the opinion that this dark bile comes from the liver, and reports a bile of increased concentration in response to the introduction of substances of marked increase in concentration. Furthermore, Einhorn points out the fact that if one wishes to study the bile from the gall-bladder, the best time to make the observation is in the fasting condition and that any previous stimulation or aspiration usually succeeds in obtaining what little bile there is in the duodenum from the liver and the gall-bladder, and he believes that diagnostic theory is more valuable from the fasting bile than bile obtained by stimulation through magnesium sulphate. On the other hand, in cases where there is likelihood of swelling of the duct a suggestion such as this: *viz.*, the increased velocity of bile through the ducts, is of value.

THE GALL-BLADDER.

The Genesis of the Gall-bladder. Broman¹ discusses in a general way the origin and function of the gall-bladder. From his studies, he believes that the gall-bladder is nothing but a rudimentary organ, and, in a general way, can simply be considered part of the liver. His theory is somewhat as follows:

The gall-bladder it is believed develops from the caudal part of the first hepatic rudiment. This part is therefore called the *pars cystica*. This portion may develop simultaneously with the liver segment and reach a very large degree of development. In fact, in some of the vertebrate animals the gall-bladder is connected with the liver by means of communicating tissue. In others, it is only very slightly connected with the liver, while in man it is totally separate from the liver. Nevertheless, in certain animals it is obvious that no gall-bladder develops under normal conditions. This is particularly the case with rats, horses and pigeons. In these animals it cannot be assumed that the function of the liver cell and the ensuing mechanisms of the biliary duct is very different from those animals which have gall-bladders. In fact, many authors are of the belief that the function of the gall-bladder is of very little importance. Some authors speak of the gall-bladder as being simply a modified biliary duct, and it certainly is true that in man this organ can be removed without any very marked change in function of the hepatic system. It must be recalled in this communication, however, that there are many observers who believe that the gall-bladder has a special concentrating function insofar as the storage of bile is concerned.

Another interesting communication from Sweden is that of Lowenhjelm.² He discusses the development of the biliary capillaries in rabbits. This author observed from reconstructed models of the livers of young and grown rabbits that the majority of liver cells turned three surfaces toward the blood capillaries and three surfaces toward the other liver cells. In the center of the surface between the liver cells are the bile capillaries, which meet in a point on the surface of the liver cells.

¹ Upsala lakaref. forh. Stockholm, September 1, 1921, No. 7, vol. 36.

² Ibid., No. 21, vol. 36.

This paper takes up in a general way the origin of the biliary capillaries and would be of interest to anyone who is concerned in this subject.

Lyon, Bartle and Ellison¹ discuss the question of *biliary tract disease* with some lessons learned from duodeno-biliary drainage. In this paper the authors discuss the general question of *biliary drainage* and its application to various conditions of the gall-bladder tract. This study was an intensive one of 100 consecutive cases of gall-tract diseases in practice. Thirty-one of these cases were studied by the roentgen ray, and 35 of them by a careful review of the findings of previous laparotomies, 17 of which were operations or reoperations upon the biliary tract. Twenty-two of these cases had their appendicities removed. Ninety-four of these 100 cases were carried through a course of treatment for their condition. These authors, in discussing the various symptom-groups which Cheney describes in his paper on *Diagnosis of Gall-bladder Disease*, claimed, regarding Group 4, in which there are no symptoms except those produced by the stomach over months and years, that it is important to recognize this stage of precalculus formation. In other words, by diagnosis at this stage, many cures can be accomplished therapeutically by this method, without having later recourse to surgery. In Group 5, which Cheney describes as a group in which the gall-bladder contains stone, but gives rise to no symptoms of any kind until either some sudden attack of pain, or operation performed for some other ailment reveals cholelithiasis, the comment is made that this group can be recognized in most instances by careful study of the chemistry and physiologic properties, the cytology and bacteriology of the gastro-duodeno-biliary fluids when analyzed with, and balanced against, the evidence or data obtained by history and physical and laboratory examinations.

In their series of 100 consecutive cases, 27 gave clean-cut gall-bladder syndromes; 4 per cent, gall stone syndromes; and 22 per cent, of a mixed syndromes, gall-tract, duodenum, appendix and colon, whereas 47 per cent presented only a vague atypical dyspepsia. Eighty-eight per cent of these 47 cases showed unsuspected infection of the duodeno-biliary zone, among which 50 per cent showed streptococcus infection. Of these 100 cases, 32 would have been readily diagnosed as gall-tract diseases in the light of history and physical examination, whereas, according to the authors, 68 per cent would have failed of such diagnosis except by a study of the characteristics of the bile. The authors point out that the method of drainage of bile offers a means of diagnosis of biliary diseases to supplement the usual clinical methods, and is, furthermore, an alternative method of treatment of many types of gall-bladder and duct diseases in which there arises the question as whether surgery is, or is not, indicated. Third, a supplementary method of postoperative cases, continuing the surgical principles, the drainage in these cases incompletely cured by surgical means alone.

It is not necessary, in this communication, to go into the details regarding the separate collection of the various biliary samples or an explana-

¹ American Journal of the Medical Sciences, January, 1922, No. 1, 163, 60, and February, 1922, No. 2, 163, 3, 223.

tion of the various characteristics of the samples obtained. They point out, from a consideration of their cases, that surgery has, in the first place, failed in too large a percentage of cases to free the biliary tract of infection. They point out also the fact that the probable points of primary infection are to be found in the tonsils, gums or teeth, sinuses, and the bronchial trees; and the five secondary foci are the stomach, the duodenum, the gall-bladder, the appendix and the recto-sigmoid colon. In the 12 cases previously operated upon, they were able to demonstrate by cultural methods infection in 9 cases, and in 10 of these there was pathogenic focal infection in the tonsils, teeth or sinuses. Of 84 cases, they could classify all of them as having various degrees of cholecystitis; they found 39 with suspicious teeth, 29 cases of infected tonsils; 18 cases had pyorrhea; 17 cases had postnasal discharge, 3 of which were proved sinus infection; 6 cases had chronic bronchorrhea; 4 cases had chronic otitis media.

Regarding the question of biliary drainage in the fasting stomach, they found that 71 per cent of cases which had been operated on showed both fasting and digestive biliary regurgitation as against 47 per cent of fasting and 23 per cent of digestive regurgitation in the non-operated cases. This would seem to indicate that gall-bladder operations had definitely destroyed the physiology of that segment of the bowel.

Regarding the bacteriologic findings, positive bacterial findings were demonstrated in 93 cases. Of the 93, streptococcus was found in 50 per cent; the staphylococcus in 25 per cent; the colon bacillus in 15 per cent; the bacillus subtilis in 8 per cent; bacillus pyocyaneus in 1 per cent and bacillus typhosus in 1 per cent. Fifty-six of these cases gave evidence of a duodenitis. In 94 of these cases biliary treatment was carried out. The duodenum was disinfected and a duodenal enema of Ringer solution was given, reinforced when necessary with sodium sulphate, thus sweeping out of the intestinal tract such infected bile. The duodenal enema of 250 cc is kept at 103° F. and allowed to drop in slowly in not less than twenty minutes. Of these cases, 73 showed a complete arrest of symptoms; 17 showed a partial arrest, and 4 of them were unimproved. In 47 cases it was demonstrated that there was a normal return of bile, while 45 cases still showed abnormalities in bile. The authors then proceed to give clinical accounts of a series of cases in which this method of treatment was carried out. These cases represent divergent types of cases and they are well worthy of perusal.

Selman, Martland, Synnott¹ discuss the question of *non-surgical biliary drainage* in diabetic and hypertension cases. Of 53 diabetic and 4 other patients with whom the procedure was used, 20 had a positive history of gastric or biliary symptoms. Of these 20 cases, 3 gave positive results and 3 a diagnosis of suspected infection. With a special study made of 6 cases, the first 1 had hypertension, was diabetic and the gall-bladder had been removed in 1914; 1 had chronic pancreatitis and 4 had frank diabetes.

¹ Journal of Metabolic Research, March, 1922, 1, 357.

The authors came to the following conclusions:

1. The negative findings in 49 out of 53 diabetic cases in the present series support the theory that most cases of diabetes are not due to ascending duct infections extending into the pancreas, but more probably to previous attacks of blood-borne infections such as the acute infectious fevers.

2. An appreciable number of patients with previous infection of the biliary or upper abdominal region show evidence of extending infections. It is important to clear up such infections in order to eliminate one of the main factors contributing to downward progress. In the case of hypertension, elimination of the focus may destroy the toxic bacterial factor which tends to maintain hypertension.

3. The Lyon method is the only non-surgical diagnostic procedure to determine whether or not the biliary system is infected. When infection is present, the value of this method as a mode of therapy in certain cases of diabetes remains to be demonstrated.

Clarke and Perry¹ discuss the question of gall-bladder diseases. These individuals were not able to obtain information reliable enough by biliary drainage to attach any extraordinary significance to it. In this article the general findings associated with gall-bladder disease are discussed.

Gibson² has used biliary drainage with apparent benefit and with good results. He says the Lyon-Meltzer technic is not difficult, but requires time, patience, and a careful technic to secure the best results. It is not only of diagnostic value, but therapeutic, and is worth while in all cases associated with biliary stasis, but is of obviously little value in cholelithiasis and chronic cholecystitis with thickening of the walls of the gall-bladder.

Synnott³ discusses the diagnostic and therapeutic value of Lyon's method of non-surgical biliary drainage. This author discusses, in a general way, the technic used, and points out the fact that infection of the gall-bladder and gall-ducts is not to be overlooked even though there be no symptoms referable to this condition. He discusses, in a general way, the method which is commonly employed by Lyon, and others, and suggests that this technic should form a part of every search for focal infections. It can be used for an accurate diagnosis of duodenitis, choledochitis, or cholecystitis. Two typical cases are given.

Smithies, Karshner and Olsson⁴ discuss *non-surgical drainage of the biliary tract*. In this paper, which is a complete one, these authors attempt to reply to the criticism which has been launched against this method. For instance, it has been claimed that magnesium sulphate does not do anything which hydrochloric acid, salt solution, peptones, food, water, foreign bodies, and other substances, are capable of doing. These authors do not deny the truth of this criticism, but point out the fact that the use of magnesium sulphate solution has certain well-

¹ Virginia Medical Monthly, 1922, **49**, 74.

² Northwest Medicine, March, 1922, **21**, 79.

³ American Journal of Surgery, June, 1922, **36**, 136.

⁴ Journal of the American Medical Association, December 24, 1921.

defined traits. Then, again, it has been pointed out that there was no necessity for the direct introduction of magnesium sulphate into the duodenum through a tube; that this solution introduced into the stomach produces the same effect as when used in the duodenum. The authors point out again that the haphazard fashion of introducing magnesium sulphate in that way is very different from the method of direct application suggested by Meltzer and Lyon. Surgeons have stated, for instance, that the method is not of service, inasmuch as, laparotomy with a duodenal tube in position, the injection of magnesium sulphate solution has not been followed by visible contraction of the gall-bladder. These authors point out the fact that in diseased conditions of the biliary tract, it is hardly probable that such a mechanism would occur. Furthermore, that it is a well established observation that the general anesthetic can be considered successful only when administered to the point of inhibition of intestinal peristalsis and relaxation of the abdominal muscles. These authors point out, however, the fact that it has been shown on incompletely anesthetized individuals and on dogs whose duodeni have been segregated, local introduction into the duodenum of hyperisotonic solutions of magnesium sulphate, with subsequent early withdrawal, produces a definite visible dilatation of the viscus, contraction of the gall-bladder and of the bile-ducts with outpouring of bladder and liver bile.

Furthermore, the authors point out to those authors who claim that the dark "B" bile is liver bile produced by the action of magnesium sulphate on the liver, that according to the observations of Meltzer and Auer, and also Mendel and Benedict, the magnesium salts are rarely absorbed from the alimentary canal. The authors ask where, in the course of the biliary passages from the ampulla of Vater to the liver, can such accumulations of the special type of bile be held, if not in the gall-bladder. Furthermore, it is a common observation that following gall-bladder removal, or drainage of the gall-bladder, one may obtain a bile which is darker in color or even mucoid. This does not flow freely under pressure as does the "B" fraction normally. Furthermore, they point out the well-known fact that when patients have had a cholecystectomy operation performed, dilatation of the common or the hepatic ducts is frequently pronounced, accounting for a certain amount of storage until there is a digestive demand for it.

These authors carry out their treatment, usually studying the patient only after an absolute twelve-hour fast, with the stomach and duodenum food-free. Sterile tubes are passed and lavage of the duodenum or stomach may, or may not, precede the injection of the magnesium sulphate solution. They inject the magnesium sulphate solution into the duodenum and then withdraw the solution within three minutes of its slow injection, which does not permit of very marked intestinal stimulus. From one-half to practically all of the magnesium sulphate solution can thus be recovered in the majority of instances.

In some 1500 drainages, they summarize the findings in 679 carefully controlled attempts. In 584, or 86 per cent of sessions drainage, was satisfactory, and failure was experienced in 94, or 13.85 per cent. The

unsatisfactory cases were due mainly to the failure of the tube to reach the stomach, obstinate vomiting or persistent pylorus spasm. It is interesting to observe that of 104 patients from whom any quantity of spontaneously discharged biliary fluid was recorded, in 61.5 per cent some degree of liver enlargement was recorded at the time of physical examination. The time interval elapsing between the patient swallowing the tube and the appearance of the bile containing duodenal aspirates varies considerably. Only 1 patient gave a satisfactory response in less than two hours. Between two and four hours was required by 67; from four to six hours by 291; and longer than six hours by 188. In their series of studies, they point out the fact that segmentation of bile was practically feasible, but that of 309 cases gall-bladder bile was not secured from 100 cases. The authors believe (1) that the non-appearance of bile-stained fluid in the duodenal contents after the injection of magnesium sulphate solution, (2) a quantity of common duct bile greater than 25 cc in which are abnormal sediments, such as blood plus increased cholesterin pigment, calculi, epithelium, mucus and bacteria, (3) or an absence of gall-bladder bile following repeated magnesium introduction, indicating some disturbance in the reflex or cystic duct, or atony, or even disturbances of the gall-bladder, or inspissation of the contents, or malignant adhesions; and, (4) securing of too much gall-bladder bile in quantities greater than 75 cc, are all evidences of trouble of the biliary tract.

It is needless to say that a thorough physiologic and bacteriologic examination of the specimens must be made. It is interesting to note the findings in Smithies cases. Living colon bacilli were found in 75.4 per cent of cases; staphylococci, in 14.9 per cent of cases; streptococci in 52.6 per cent of cases; yeast bacilli typhus micrococci, in 4.38 per cent.

These authors point out the fact that it is a mistake to assume that this method relieves obstructive lesions, known calculi, tumors and the like. Unless this fact is realized, this method will fall in repute, both as a diagnostic and a therapeutic agent. The procedure is of importance, however, in this group of cases. Inflammation of the ducts or gall-bladder, or even in certain infections of the liver, hepatitis of toxic origin such as ptomain, lead or phosphorus poisoning, biliary stasis of various forms, heart diseases, serious severe anemias, in dyspeptic storms with recurring biliousness, in chronic rheumatoid infections where presumably the biliary tract is involved, in fact, in all cases of biliary tract infection, in some of the cases of atypical ulcer with bilious manifestations, in associated gall-bladder and intestinal diseases. In those cases it is suggested that this method may be of considerable value to relieve stasis. They suggest frequent drainage of from three to six days apart.

Bassler, Luckett and Lutz¹ discuss the question of drainage of the biliary system and come to the following conclusions:

1. The assumption by Meltzer of the law of contrary innervation is not proved, and these authors even doubt any specific effect on the

¹ American Journal of the Medical Sciences, November, 1921, **162**, 647.

location of the sphincter of Oddi and contraction of the gall-bladder induced by magnesium sulphate solution.

2. Any one of many substances taken into the stomach or injected into the duodenum will cause a ready flow of bile, of which a solution of hydrochloric acid in about one-third the acidity of normal gastric juice is the most potent for discharge of bile in large quantities and obtaining characteristic "B" bile.

3. That the deep color of "B" bile is due to oxidation and not concentration from retention in the gall-bladder. This bile can be found coming directly from the liver as a phenomena of bile secretion.

4. That the viscosity of bile does not elevate its specific gravity to any practical extent.

5. That the margin of error in deducting from the presence of mucopurulent flakes, pus cells, inflammatory debris, bacteria and cells in the aspirated bile as positively coming from the gall-bladder is too great for clinical deduction.

6. That the physiology of the gall-bladder should not be deduced from anatomy and relationship alone; that its most important function seems to be to relieve pressure within the biliary system, to protect the pancreas rather than acting as a reservoir for bile in a digestive sense, and that the physiology of bile secretion and gall-bladder function should be studied more thoroughly.

7. That cholectomized individuals show the characteristic "B" bile even shortly after operation, before the ducts have had a chance to dilate. This occurs so commonly that "B" biles cannot always be from the gall-bladder.

8. The increase in specific gravity in aspirated bile, by this method, is due to the content of magnesium sulphate which appears to be re-absorbed into the portal circulation and is excreted by the liver substance in the bile. It is erroneous to deduce clinically in both amount of biles obtained by any gradation (A B C D), or by specific gravity estimations as to whether bile stasis exists or not.

9. That where true pathology exists in the gall-bladder, the method is a poor substitute for proper surgery. It may be employed in suitable cases as a temporary means, but it should not be depended upon to correct or definitely benefit pathologically diseased gall-bladders or when gall stone exists.

In a certain article in the *New York Medical Journal*, March 1 and April, 1922, Lyon replies to certain antagonistic criticism of the method of biliary drainage. He points out the fact that Brown, Smithies, Wipple, Simon, Sachs, Friedenwald, Synnott, Levin, Niles, White, and others, have confirmed the soundness of the principle on which this method of treatment and diagnosis rests. On the other hand, certain writers, Einhorn, Crohn and associates, Dunn and Connell, Bassler, and others, as the result of their experimental observations, have attacked the very roots of the method which he proposes to answer.

Regarding the idea that many substances can give rise to this form of stimulation, and that magnesium sulphate is not alone in this property, he points out the fact that he had never contended that this was the case,

but was of the opinion that magnesium sulphate had the greatest power to relax the duodenal wall, and then came peptone, and, finally, hydrochloric acid. Regarding Einhorn's statement, Lyon replies to that by stating that the abrupt transition is hardly to be expected, but may occur, dependent largely upon the question of the intactness of the gall-bladder and duct musculature and its tonus. Regarding the assumption of Einhorn that the stronger the mixture of magnesium sulphate, the darker the color of the bile, he mentions the fact that this is entirely within keeping with the theory that weaker solutions will not deliver as much dark colored bile as the stronger solutions. He furthermore acknowledges that many solutions, such as sodium sulphate, bicarbonate of soda, and other chemicals, act in a similar manner, but do not influence the gall-bladder musculature to the same extent. Regarding the sequence of the dark bile to follow the reintroduction of Epsom salts, he points out the fact that this view is fallacious, and also mentions that it is possible for such a sequence to take place in the presence of atony of the gall-bladder, or partial obstruction of the cystic duct. Regarding the question of dark colored bile in cholecystectomized cases, Lyon has seen few cases in which there was a real dark colored bile. In fact, the bile is rather of a different tint, and more often this phenomena occurs where there is dilatation of the ducts or even the formation of a definite diverticulum.

Regarding the question of Einhorn's work, he notices the Einhorn reports his bile as alkaline, where as the bile is usually acid in reaction. Furthermore, Fitts, of the Mayo Clinic, has pointed out that gall-bladder bile has a higher acidity than bile from any other portion of the tract. They reply to the paper of Crohn regarding, first, the demonstration of a functioning sphincter at the mouth of a common bile-duct. He believes that this is clearly demonstrated, even from Crohn's own experiments, certainly the demonstration of the contrary nervous mechanism evolving the gall-bladder and ampulla; and this the author explains by the fact that anesthesia is supposed to effectually blot out all reflexes, although in one case Sax apparently succeeded in successfully visualizing the gall-bladder evacuation when all others failed. As to the specific effect of magnesium sulphate, Lyon goes on record as saying that magnesium sulphate possesses some properties not possessed by peptone, or the other chemicals tried, which favors the evacuation of the gall-bladder contents if in no other way than by lowering duct pressure. The author criticizes the method which Crohn uses in the carrying out of his test. Crohn, for instance, questions the significance of cholesterol crystals found in the bile, but the author is of the opinion that these crystals indicate either calculus or precalculus formation. The question of the evidence that "B" bile is gall-bladder bile, and also evidence to prove that the careful microscopic and chemical examinations of the biles are of great diagnostic importance is presented both ways; and the author clearly exposes his platform regarding the whole situation.

His reply to Bassler's criticism is again the fact that in those cases which were examined at operation, there was a blunting of the reflexes due to anesthesia. The author criticizes both the method of Bassler

and Crohn and acknowledges that in its broad aspects Meltzer's law of contrary innervation is not definitely proven, but denies, however, the fact that Bassler has presented any evidence which would throw doubt upon the specific effect of magnesium sulphate. In this paper, he also denies the fact that the bile obtained with hydrochloric acid is similar to the gall-bladder type of bile which is obtained with Epsom salts. He, furthermore, denies the fact that "B" bile is obtained from individuals who have had a cholecystectomy performed.

The reviewer hesitates to express an opinion regarding this latter controversy, inasmuch as he believes that the last word has not been said regarding the significance of the types of bile obtained by duodenal intubation. He has performed a method of duodenal intubation for more than seven years and has done many thousands of biliary drainages. He follows the same method of examination of the bile today that he employed several years ago, and that is careful study of the microscopic and chemical appearance of the bile, together with careful culture of the material obtained. Where possible, any evidence indicating the localization of the lesion is naturally taken into consideration. He believes that Lyon's work has at least stimulated great interest in the question of duodenal and biliary diagnosis, and feels that it is almost too soon to form a tentative conclusion regarding the importance of this method of diagnosis.

Regarding biliary drainage and treatment, he has used this method over this period of time with great variety of conditions and expects sometime to report of his findings. There is no question but that this method of treatment has its field of usefulness. He uses a Murphy drip in the duodenum with a drip of the various substances calculated to produce results. For years, the reviewer used a combination of sodium bicarbonate, sulphate and phosphate, and performed transduodenal lavage, a method which, from its therapeutic results, he has not seen fit to change. On the other hand, however, we are satisfied that duodenal intubation and the examination of the duodenal fluids is a method of procedure which cannot safely be ignored.

Tenney and Patterson¹ discuss the question of the *injection of bile-ducts with bismuth paste*. (1) In the case reported, that of a laborer, age forty-eight years, the bile-ducts of the human liver were apparently injected and the patient recovered without apparent damage. (2) Magnesium sulphate did not increase the flow of bile, nor did it increase in color or constancy. The magnesium sulphate acts only as a stimulant to contractions of the gall-bladder and causes dilatation of the ampulla of Vater, and not as a direct stimulant to the liver except as the bile in the duodenum increases it. (3) The greatest quantity of bile was secreted during the third and fourth hours after meals. (4) Psychic tests showed no immediate change in the flow of bile. (5) One may get normal liver bile by the use of the duodenal tube for diagnostic purposes, even when the patient has a markedly diseased gall-bladder. (6) The entrance of bile into the duodenum definitely increases the flow of bile

¹ Journal of the American Medical Association, January 21, 1922, No. 3, 78.

from the liver. (7) Magnesium sulphate injected into the duodenum which had no connection with the liver did not increase the flow of bile. (8) Bile injected under the same conditions did increase the flow of bile.

Kallen¹ discusses the question of the *barium meal in gall-bladder diseases*. This author points out the extremely important findings which the roentgen ray can give toward gall-bladder diseases, and mentions the following points as evidence of a chronic inflammation of the gall-bladder:

1. Pressure defect of the superior margin of the duodenal bulb. Formerly this was supposed to be entirely due to the gall-bladder. Today we know it can be due to the liver as well, and is constant because of the fixation of the duodenum and the gall-bladder or liver, or both.

2. Adhesion deformity of the superior margin of the duodenal bulb. This is recognized by the loss of the smooth outline and the jagged irregularity which replaces it.

3. Permanent alteration in the position of the duodenal bulb. This is recognized by a displacement of the duodenum from its axis, displaced usually to the right or downward, or to the left.

4. Adhesive defect of the second and third parts of the duodenum with loss of the symmetrical valve markings, and their replacement by a constant unsymmetrical outline.

5. Permanent alteration in the position of the second and third portions producing, not infrequently, acute angulation, or even left-sided displacement back of the pylorus.

6. Delay in the second and third parts of the duodenum, best seen fluoroscopically.

7. Defects of the lesser curvature of the stomach near the pylorus which are not due to ulcer or cancer owing to the fact that it is not clean-cut and punched-out and finger-like in appearance as in the later condition.

8. Chronic contraction of the pyloric antrum, a condition not infrequently seen in this condition.

9. Displacement of the pyloric antrum, usually to the right and up, as though it were folded back toward the lesser curvature.

10. Gross deformities of the fundus of the stomach due to bands or adhesions.

11. Adhesive defects of the upper jejunum with loss of symmetry of the valve markings and reduction in caliber of the area effected, and an irregular outline of one or both margins.

12. Pronounced alteration in the coils of the jejunum.

13. Delay in the jejunum both fluoroscopically and radiographically.

14. Tenderness in the gall-bladder region.

15. The characteristic picture and gall-stone shadows, which must be differentiated from right renal calculus, and enlargement of the mesenteric glands, or even the contents of the colon.

16. Shadows of physiologic gall-bladders of doubtful significance. This is difficult to determine and must be done with extreme care.

¹ Northwestern Medicine, June, 1922, No. 6, 21, 172.

17. Angulation of the colon immediately beyond the hepatic flexure is not uncommon.

18. Dilatation of the ascending colon needs no explanation. This is usually associated with considerable stasis.

19. Pericolic membranes at or near the hepatic flexure.

20. Pericolic membranes of the entire transverse colon.

We consider this article an extremely good one, inasmuch as it reports in a satisfactory fashion pretty nearly all of the conditions which are encountered in diseases of the gall-bladder. Particularly would we point out the importance of the secondary findings in gall-bladder disease. These secondary findings are: Cardiospasm, reflex pylorospasm, mechanical obstruction at the pylorus or duodenum, reflex spastic colitis, all of which are frequently associated with gall-bladder manifestations. The author points out the importance of and the desirability of a thorough search for the primary focal infection.

The writer also mentions the studies of Aschoff regarding the arrangement of the mucous membrane and the *magenstrasse* as possible causes for the general arrangement of ulcer.

PANCREAS.

Syphilis of the Pancreas. Wile¹ discussing visceral syphilis mentions syphilis of the pancreas, which, while not uncommon in the new born, in the acquired form is one of the rarest of syphilitic visceral lesions. From a pathologic standpoint, Warthin believes that chronic interstitial pancreatitis is one of the most frequent visceral lesions found in latent syphilis. The condition may occur either as a gummatous pancreatitis or an interstitial pancreatitis, or a combination of the two. The symptoms are not pathognomonic, but jaundice without other cause, glycosuria, and pancreatic tumor without cachexia, are suggestive. The therapeutic test is the most efficient diagnostic aid.

Pancreatitis Following Mumps: Report of a Case with Operation. The occurrence of pancreatitis of mumps has been reported many times, but Farnam² is the authority for the statement that in only one instance was there an autopsy reported to furnish objective evidence of the disease. Many works on medicine do not mention the association of pancreatitis with mumps. The possibility of simultaneous involvement of these two glands, the parotid and the pancreas, has been commented upon by many observers.

In 56 reports the number of days between the onset of parotiditis and abdominal symptoms is given. In 28, the interval was from four to seven days; in 10 cases it was less than four days; in 4 cases it was two weeks. Males are more prone than females. The sex mentioned 99 times showed 81 males and 18 females. The age incidence of 58 cases was at least eighteen years of age, and 31 are mentioned as children. The duration of the attack is usually short, in many instances the authors imply that the attack lasted twenty-four to forty-eight hours.

¹ Archives of Dermatology and Syphilology, 1921, 3, 117-122.

² American Journal of the Medical Sciences, 1921, p. 859.

The longest duration was twenty-five days, and apparently all but the patient of Lemoine and Lapasset (an Algerian soldier) recovered. This was the case which came to autopsy.

Epigastric pain and tenderness are the symptoms given. The pain may be so intense as to necessitate morphine, and is usually accompanied by nausea and vomiting. Diarrhea is not as frequent apparently as the text-books of medicine would lead us to believe, but 13 out of 30 accounts of the intestinal function mention diarrhea and 10 were constipated. A mass in the epigastrium was only felt 13 times. There is usually a slight rise in temperature. Sugar was only found in 2 cases out of 23 in which it was sought. Acetone and diacetic acid were found 4 times, each time associated with severe vomiting.

A summary of the 119 cases collected reveals the following generalizations: An acute abdominal condition. Probably pancreatitis is sometimes associated with epidemic parotiditis. It occurs more often in boys and young men than other classes of the population; it usually follows, but may precede, the parotiditis. It is characterized by intense epigastric pain, often vomiting, occasional diarrhea or constipation and a slight rise in temperature. A mass may sometimes be felt in the epigastrium. It usually runs a short, benign course and has not been shown to affect the internal secretion of the pancreas.

The author describes a case of a young Italian, aged twenty years. Operation disclosed acute pancreatitis, and culture showed the *Streptococcus viridans*. The patient left the hospital in good condition.

Tumors of the Pancreas. According to Lockwood,¹ primary tumors of the pancreas are rare. Cysts, carcinomas, adenomas, sarcomas and limpomas are found in the order mentioned. Of the solid tumors, carcinoma is the most frequent and sarcoma the least, while primary sarcoma is rare.

This paper discusses the *diagnosis of tumors of the pancreas*, and also presents a case of sarcoma of the pancreas. In discussing the question of diagnosis of tumors of the pancreas, the author mentions the difficulties encountered, and names the following symptoms as common to all tumors of the pancreas: (1) Pressure symptoms exerted by the tumor upon surrounding structures. The close proximity of the pancreas to the large vessels posteriorly, and its intimate relation to the liver, stomach, duodenum, spleen and kidney, give rise to a complexity of symptoms often difficult to interpret. By pressure on the large vessels, they may occasion edema or ascites, and, by pressure on the common duct, persistent jaundice. Pressure on the renal veins is reported by Ransohoff to produce marked hematuria. Pressure on the stomach and duodenum often causes distension and filling defects, simulating a tumor of the stomach on the roentgenogram.

In the reviewer's experience, this concave deformity in the contour of the gastric image is one of the most important points in the diagnosis of tumor. (1) Pressure on the solar plexus gives epigastric pain. Tumors of the tail give fewer pressure-symptoms, owing to greater room for

¹ Journal of the American Medical Association, November 12, 1921, No. 20, 77, 1554.

expansion, and may simulate tumors of the spleen or kidney. (2) Fatty stools, due to pressure on, or closure of, the external pancreatic duct. This disturbance may be noted not only by the character of the stool, which shows large amounts of unsplit fat, but also many undigested meat fibers. Other tests of external pancreatis function demonstrate the same defect. (3) Sugar in the urine has been reported infrequently. (4) One of the most characteristic findings is rapid emaciation, with cachexia and weakness.

A description of a sarcoma of the tail of the pancreas is given, together with the history, roentgen-ray studies and operative findings of the case. This tumor made a large defect in the image of the stomach on the roentgen-ray plate.

Roentgen-ray Studies in Pancreatic Disease are discussed by Herrenheiser.¹ The examination of pancreatic disease up to the present is mainly confined to indirect evidence, although pancreatic calculi give a good picture, inasmuch as they are mainly calcium concretions. Tumors of the pancreas are determined largely by compression and displacement of adjacent organs.

The author discusses four types observed: (1) Changes in the middle portion of the stomach, which are caused by tumors in the body or tail of the pancreas and also in the left portion of the head. These changes are usually of the lesser, and not the greater, curvature, and rarely in the central part of the gastric image. They may be due to indentation of the lesser curvature, in which case a differential diagnosis is necessary between intra- and extragastric lesions; and second if extragastric, whether pancreatic or some other organ. Furthermore, we have compression of the greater curvature which is shown on the fluoroscope, and by palpatory procedures under the fluoroscope, as well as pneumoperitoneum. Pancreatic tumors which are covered by the posterior wall of the stomach may produce the same roentgenologic signs as a tumor of the anterior or posterior wall of the stomach. The pyloric portion of the stomach is caused by tumors or deeply placed cysts of the head of the pancreas. Alteration of the duodenum is not infrequently noted with carcinoma of the head of the pancreas. Even the colon may be depressed and narrowed in its transverse portion by tumors of the under surface of the pancreas. Gas abscesses of the pancreas may be detected by demonstrating an accumulation of gas in the middle part of the epigastrium, superimposed over a level of liquid, and have no relation to the stomach. But inflammations of the pancreas which do not alter its contour, or produce pressure manifestations on adjacent organs, are difficult, or impossible, to detect.

APPENDICITIS.

Laroche, Brodin and Ronneaux² discuss the question of *chronic appendicitis* and the importance of roentgen-ray examination for chronic appendicitis. It is pointed out that many of the commonly accepted

¹ Med. Klin., Vienna, February 23, 1922, **18**, 229.

² Presse Médicale, Paris, April 18, 1922, **30**, 297.

physical signs of appendicitis are not sufficient to justify the diagnosis of chronic inflammation of this organ. Pain is the important symptom, but inasmuch as pain depends upon the position of the appendix, and that is sufficiently variable, it follows that pain will be markedly different. It is likewise somewhat difficult at times to make a differential diagnosis between appendicitis and right-sided salpingo-oöphoritis. The appendix and ovaries may be in contact, making this more difficult, so that chronic inflammation of the appendix can be associated with exacerbations during the period. Furthermore, pain along the course of the right ureter is liable at times to give difficulty. It therefore follows that roentgen-ray examination of the organ is of value, but one cannot draw conclusions regarding the appendix from its visibility alone. The most important method of examination should be a fluoroscopic examination combined with palpation, which will give valuable evidence as to the position of the painful point, the mobility of the cecum and the appendiceal region and also the association of the tender point with the appendix. It is only when the painful point follows the change in position of the organ that it is possible to say definitely that these two are due to the same condition. A painful point, at the root of the appendix or in the neighborhood of the iliocecal valves, which moves when one moves the large bowel is one of the most satisfactory signs of chronic appendicitis. When, however, this painful point remains in one position, and the bowel and appendix can be moved without altering the position of the point, one must think of trouble in the pelvis. Other painful points that are to be remembered are those due to the omentum and the sympathetic nervous system.

Waitzfelder¹ discusses the question of the demonstration of chronic appendicitis with the roentgen ray. In this paper mention is made of the demonstration of fecal concretions in the appendix which can be demonstrated by the roentgen ray. Stretching or kinking of the appendix points also to a chronic inflammation.

The best time to examine the appendix with the roentgen ray is from six to eight hours after the ingestion of an opaque meal, and it is pointed out that if the appendix becomes rigid during digestion without change in form or position, that finding is another sign of appendiceal inflammation.

Jamieson² discusses the *acute appendix*. In this condition, naturally it is extremely important to make an early diagnosis. The pain is usually colicky and intermittent, almost always at first situated in the epigastrium or just above the umbilicus and reaches its height in from four to ten hours. Later it radiates down to the lower right quadrant of the abdomen and then, finally, remains in this position. By the third day pain may have subsided, indicating a lessening of the process; or it may become more severe, indicating a spreading peritonitis. In any event, in almost every case there is right-sided tenderness. There may be a slight temperature; nausea and vomiting may also occur. There is usually an increase in leukocytes due to the absorption of poisons, but

¹ Med. Klin., Vienna, March 2, 1922, **18**, 281.

² Canadian Medical Association Journal, April, 1922, **12**, 232.

an important point is the question of the types of leukocyte count. A stationary leukocyte count with an increased polymorphonuclear count points to gangrene. Physical examination demonstrates the presence of swelling, tenderness, muscular rigidity, whether or not these phenomena are localized or general, and also the extent of tenderness. Often extension of the right leg will produce some pain over McBurney's point. It is always desirable in these cases to make a rectal examination and nothing should be left undone.

Stinsur¹ discusses the treatment of acute appendicitis. Naturally, mention is made of the two methods by which this disease is handled, that of operation, and that of watchful waiting and careful medical treatment. Everyone is agreed on immediate operation in the gangrenous and perforating form of appendicitis.

One observer summarizes the *indications for immediate operation* as follows: (1) Ice is not effective; (2) vomiting is persistent; (3) the temperature rises; (4) there is localized pain, and the abdomen instead of remaining flaccid, contracts and also becomes distended.

If medical treatment is employed at all, starvation should be commenced at once and should be complete. The lips and tongue may be moistened, but no water should be swallowed, and the Murphy drip may be used if necessary. Ice application should be sufficiently large to cover the entire intestinal tract so as to inhibit peristalsis. Morphine is given simply to relieve pain, although there is a great difference of opinion regarding the use of this substance.

Guillard² discusses more *deceptive forms of appendicitis*. This article deals mostly with the association of the appendix to the menopause. The facts are based on the study of 8 cases followed in the course of the last three years, and simply emphasize the contingencies that may arise between the diagnosis of appendicitis and the physiologic disturbance of the menopause. There is no question, however, that the fact that a woman is at the critical age does not exclude the possibility of appendicitis, but it is likely that there are individuals who show appendiceal symptoms which cease completely when the menopause is fully established. There seems to be some confusion regarding this condition and it is simply to be borne in mind as a possibility.

Bogart and Cheney³ discuss the *diagnosis of chronic appendicitis*. All these cases may be divided into two groups; the first group in which there has been a previous acute attack; and another group in which there has been no history of abdominal pain on the right side. In fact, one observer divides chronic appendicitis into a still larger number of groups: (1) those associated with acute attacks extending back for several years; (2) those associated with vague symptoms but not necessarily those of acute appendicitis; (3) subacute attacks, with pain down the right leg, urinary symptoms, but not typical outbreaks; (4) chronic appendicitis; (5) involvement of the appendix as a part of a generalized chronic inflammation of the whole lower part of the abdomen.

¹ Rev. Med. Cubana, Havana, May, 1922, **33**, 388.

² Red. Med. de la Suisse Roma, Geneva, March, 1922, **42**, 9.

³ Journal of the Tennessee State Medical Association, March, 1922, **14**, 411.

In a group of 71 cases, mention is made of 31 belonging to that group in which the chief symptoms were those affecting the stomach. Some were suggestive of ulcer and had a reflex hyperacidity. Others resembled a chronic inflammation of the stomach with subacidity and spasm of the pylorus. Roentgen-ray examination is undoubtedly of great value in differentiating ulcer of the stomach and duodenum from chronic appendicitis. One should also bear in mind rare conditions, such as epigastric hernia, incipient femoral hernia, an early psoas abscess, diverticulitis, aneurysm of the abdominal aorta, gastric crisis of tabes, and early malignancy of the appendix.

Guerra¹ discusses the question of *focal infection and appendicitis*. The appendix is an organ which is particularly well adapted to localization of a general infection. Inflammation of the appendix frequently occurs in the course of acute infection, and the explanation of an acute appendicitis occurring in apparently normal individuals would suggest the localization of a focal infection in the appendix. Inasmuch as the appendix is an organ with deficient circulation, largely made up of lymphoid tissue and extremely sensitive to the action of bacteria, it is not difficult to realize that a focal infection elsewhere in the body might readily localize in the appendix. The tonsils are probably the principle seat of primary infection. This idea naturally is an old one, and the question of hematogenous infection of the appendix, particularly the acute varieties of inflammation, is one which has received recognition from many observers.

Bloch² discusses the *vagaries associated with appendicitis*. One thing is clear—appendicitis is not always associated with the same history and the same findings, and there is no one symptom which is infallible in the diagnosis of appendicitis. The diagnosis should always be made by an association of the complete clinical picture and the laboratory tests. It must be borne in mind that many conditions are liable to produce pain in the right lower quadrant of the abdomen, movable kidney, ureteral and renal manifestations. Not infrequently a high pain is due to a retrocecal appendix. Pneumonia can give rise to the same type of abdominal pain, and in every instance in which there is no rise in temperature, but in which the fulminating symptoms are out of proportion to the physical signs, one must test the knee jerks and rule out the possibility of tabes.

Adjacierno³ discusses the symptom of *pain in the diagnosis of appendicitis*. It is generally admitted that the most important point in the diagnosis of appendicitis is the symptom pain. Furthermore, the general debut of this symptom is in the epigastrium, and, finally, at a subsequent period, localizes in the lower right quadrant. In many instances, however, this symptom is only found on pressure either on McBurney's point or Munro's point, although the structure most frequently found under these points is not the appendix, but the ileocecal valve. The appendix, or at least the base of the appendix, in the living

¹ Cron. Med. Chir. de la Havana, January, 1922, p. 172.

² International Journal of Surgery, March, 1922, **35**, 82.

³ New York Medical Journal, June 7, 1922, p. 663.

subject is on an average $2\frac{1}{2}$ cm. below the valve. Pain in the right iliac fossa in appendicitis may be shown in other ways: By inflation of the colon with air (Bastedo's sign); by rectal palpation; by gentle pressure on McBurney's point; when the patient lying horizontally raises his right leg, causing the corresponding psoas muscle to contract and force the painful appendix up against the palpating fingers; by traction on the right spermatic cord; by pressure over the descending colon, proceeding in an upward direction so as to produce an antiperistaltic wave, or gaseous distention which even will produce severe pain in the right iliac fossa (Rovsing's sign); or, finally, by pressing a little below McBurney's point while the patient is turned on the left side, in which position the swollen and inflamed appendix drops down and pulls on the mesentery which is usually hypersensitive in such cases. Nevertheless, it can be stated that the symptom pain in the right iliac fossa, often in the great majority of cases of appendicitis, is not a constant one, being absent in particularly all cases of chronic, latent appendicitis or appendicitis with referred symptoms, such as the dyspepsia type of appendicitis, juxta-cecalis duplivulvita, where the diseased organ is completely matted to the external wall of the cecum and concealed by the visceral peritoneum covered by another thin membrane layer, or the so-called veiled appendix. Toxic appendicitis is, however, a variety in which the general phenomena of intoxication, with even severe diarrhea and albuminuria, may occur. In this group of conditions the symptom of pain may be latent or concealed.

As a rule, however, in all acute cases the initial symptoms are paroxysmal or cramp-like in character, and referred to the epigastrium or to the mesogastric region, almost always accompanied by nausea and vomiting and followed by pain, rigidity and tenderness in the right iliac fossa, and rise in temperature and increase in the number of leukocytes. The pain and tenderness usually became apparent in the right iliac fossa as soon as the diffuse initial pain subsides. In children, however, the epigastric signs overshadow the lower right-sided pain, and are usually rapidly followed by symptoms of general peritonitis. In many forms of chronic appendicitis, however, recurrent symptoms are often in the stomach rather than in the lower right side. On the other hand, the mere symptom pain in the lower right quadrant is not sufficient evidence of the existence of an appendicitis.

While the author gives a differential chart of over one hundred conditions which may simulate appendicitis, the important conditions which ought to be borne in mind are as follows: A right floating kidney; movable cecum; ileocecal tuberculosis; adenitis of mesenteric glands, especially tuberculosis; actinomycosis; acute suppurative periostitis of the inner surface of the ilium; tabetic crisis; anginoid pains due to sclerosis of the upper mesenteric artery. Furthermore, there are a number of cases characteristic of transient tenderness and pain in the appendiceal region, and by absence of other signs or symptoms of a true appendicitis, usually occur sometime in the course of some infectious disease, such as acute rheumatism and tonsillitis or mineral poisonings (saturnism), or primary anemias, or anaphylactic disturbances, such as those associated with

urticaria, eczema and serum diseases. There is undoubtedly in these cases toxic substances in the blood which stimulate the nerves going to the appendix. For this group the author suggests the term appendicodynia.

This article is given over to a consideration of many of the different forms of appendicitis which are encountered, and is well worthy of perusal as a rather concise exposition of the subject.

Struthers reported several cases of transient acute lymphadenitis associated with pain, swelling and tenderness which might simulate appendicitis. Cases are mentioned in which this mistake resulted in operation and the removal of apparently normal appendix.

Cecocolic Lesions in Chronic Appendicitis. An abnormal mobile cecum is not infrequently associated with appendicitis of the chronic variety. Chaliel¹ found this condition in 80 per cent of cases in women and 75 per cent of cases among men. It is frequently accompanied by adhesion formation, perityphilitis and ascending pericolicitis. In such cases appendectomy should be accompanied by fixation of the cecum. The article deals with the appropriate surgery for this condition.

Ulcerative Colitis. Martini and Udaondo² discuss the important question of ulcerative colitis. Regarding the cause of the condition, there are many different predisposing factors, among which are chills, excessive or faulty hygiene and diet, as well as the ingestion of contaminated food-stuffs, malformation of the colon as in its mesentery, the situation of the sigmoid flexure and the existence of abnormal colon ligaments, diverticuli as well as traumatism and infection of the mucosa are all important. The most important single activating cause is constipation. Not infrequently, determining causes are toxic poisoning of various kinds from mechanical poisons; mercury, arsenic, and from the poison adulterated bismuth. Among parasites may be included amœba of dysentery; among worms, the ascaris trichocephalus, ankylostoma, tœnia, bothriocephalus and fungi, monilia enterica, spirilla and aspergillus. Syphilitic, tuberculous, neoplastic, and gonococcal ulcers may be found.

Regarding the symptomatology of this condition, there is practically always some form of diarrhea present, usually with the presence of pus and blood in the movements. The average number of movements is from four to ten a day. There is not infrequently rectal tenesmus in acute cases. There may be a rise in temperature, general weakness and excessive swelling and tenderness of the abdomen, and profuse diarrhea. In the chronic forms this is not usually so pronounced, but there is diarrhea, a sensitive colon, often palpable, and periodic acute exacerbations. Proctoscopy reveals ulcers accompanied frequently by mucopus, and the roentgen ray of the colon confirms the diagnosis. Almost always there is spasm on the left side of the colon. This condition most frequently affects the terminal portion of the recto-sigmoidal portion of the colon, inducing tenesmus and painful defecation. Occasionally, there is a diffuse ulcerative colitis. Complications include hemorrhage, peritonitis, skin eruptions, not infrequently focal infections

¹ Bull. et mem. soc. de Chir. de Paris, April 4, 1922, **48**, 486.

² Review Assoc. Med., Argentina, Buenos Aires, December, 1921, **34**, 465.

elsewhere, venous thrombus, and even fatal endocarditis have been noted.

Briefly enumerated, the following are the methods of treatment which have been suggested: Restricted diet, systematic disinfection of the bowel if diarrhea is excessive. Adrenal serum and glucose serum can be given drop by drop, or even urotropin serum. Colon lavage with isotonic solutions of sodium chloride, tannic acid, calcium chloride, silver nitrate, hydrogen peroxide, permanganate of potash, methylene blue and magnesium chloride may be used. In the curative treatment, the most important thing is vaccine therapy. Mixed emulsions of the colon bacillus, bacillus *aërogenes*, streptococcus and the paracolon bacillus have been used with success. Vaccine therapy must be used with care, or in fact altogether discontinued if there is hepatic, renal or cardiac disease, and should not be given in syphilitic and tuberculous diseases and new growth.

Surgical treatment includes appendicostomy, enterostomy, colostomy, partial or total resection of the colon, enteranastomosis, and iliosigmoidostomy with or without exclusion of the colon.

THE INTESTINES.

Colon. PERISTALSIS OF THE COLON. Hickey¹ discusses the question of colon peristalsis and recommends the following procedure for the observation of colon peristalsis. The colon is first thoroughly cleansed, either with an enema or with a laxative; then it is filled with the usual barium enema by means of a rectal tube. It is desirable to fill the colon to a moderate degree of distention. The rubber tube is then lowered into a pail so that the material can return into the lower pail, and the colon is studied by means of the fluoroscopic screen. Watched in this way the colon becomes the seat of active peristaltic contraction. The rectum is first emptied and then the sigmoid, and, finally, part of the transverse colon, the beginning of this peristaltic wave being to the right of the midline. Antiperistalsis ceases at this point.

This procedure is of value in diagnosis, and the author points out the fact that, in some of these cases when symptoms persist in the lower right quadrant after the removal of the appendix, it is to be noted that peristaltic waves in the cecum start, not at the tip of the cecum as they do normally, but in the upper portion, the lower part of the cecum being apparently, for the time, inactive. In some cases where it is difficult to have peristalsis owing to atony of the colon, massage may be necessary to stimulate peristalsis.

Loeper and Bauman² discuss the *action of pepsin on the motor function of the large intestine*. Pepsin stimulates intestinal peristalsis and the muscle tone of the bowel, and it is to be remarked that this stimulation occurs particularly on the right side of the colon, although the drug has little or no value as a laxative, in some cases of spastic constipation

¹ American Journal of Roentgenology, April, 1922, **9**, 260.

² Bull. et mem. Soc. Med. d. hôp. de Paris, May 11, 1922, **38**, 726.

even aggravating the condition. It is interesting to note, however, that the action of this substance is principally high colonic.

Donaldson¹ discusses the relationship of constipation to intestinal intoxication.

Within recent years a great deal of attention has been given to the question of autointoxication and an exaggerated degree of emphasis has been laid upon the liability of severe toxemia from fecal retention over the normal period of time. Donaldson is of the opinion that symptoms presented by those who seek relief from constipation cannot be taken as unquestioned evidence of the absorption of toxins; in cases of ordinary constipation, toxins are not necessarily absorbed into the blood; and, finally, in these cases of chronic constipation there may not be sufficient toxic material in the fecal retention to produce toxemia.

This author explains the symptoms of so-called intoxication on a more or less mechanical basis, that is to say, the distention and irritation of the lower bowel by fecal material, with a resulting nervous disturbance and tendency toward endocrine imbalance.

In one very interesting experiment, 5 men, normal in every way, experienced voluntary constipation by abstaining from all call to stool for a period of ninety hours, in which cases typical signs of autointoxication developed. All but 1 developed a coated tongue in sixty hours. The breath was markedly foul in 1 case. One individual developed ulcerations in the mouth. The appetite was impaired in every case, and all but 1 complained of some gas. One had nausea, the others had no gastric disturbance. Each of them became increasingly sluggish mentally, and they were depressed, restless and irritable. In all instances the night's rest was unrefreshing. Laboratory tests made within one hour after the fecal material had been gotten rid of showed that in all cases the depression and mental dulness disappeared. The author explains this marked and rapid improvement in only one way; *viz.*, that the symptoms cannot be taken as the evidence of a toxemia.

A number of experiments were performed on dogs in which constipation was induced by producing a closure of the anus. In 1 case cultures of bacteria obtained from feces of the constipated patient were introduced into a closed large bowel of a dog. Blood tests were then made to determine whether absorption of toxins had taken place. The author was led to believe, from these experiments, that absorption may take place under certain conditions, and this absorption results in changes in blood-pressure. For instance, with meat as a diet, it is possible to show, after a reasonable period of retention, an accumulation of poisons in the blood. Sometimes they make themselves known by various physiologic tests. In another experiment a watery extract of the normal feces of 1 dog showed no evidence of the presence of poisonous substances.

In conclusion, Donaldson says, "I have no intention to deny that cases of autointoxication of intestinal origin do exist in the constipated who are relieved of the clinical symptoms of autointoxication immedi-

¹ Journal of the American Medical Association, March 25, 1922.

ately after the eliminative process. There is no intoxication, no blood pollution and no toxic stool. I furthermore believe that the forty-eight hour stasis, which is the average evolution of the carmin test in sanatorium patients, does not necessarily mean a subtle poisoning. Those who admit definitely of constipation, and who admit of temporary relief after an enema, ought to be treated to correct the constipation, not the autointoxication."

Kantor,¹ in discussing the treatment for constipation, calls attention to the necessity for regularity in meal time and a normal mixed dietary, the drinking of a liberal amount of water, and the necessity of cultivating the habit of a spontaneous movement of the bowels at regular intervals. This author believes that a highly concentrated dry diet is much to be avoided. A well-balanced diet includes many green vegetables, fruits, sugars and jams. Fatigue must be grouped among the possible causes of constipation, but unquestionably the greatest cause is the vicious habit formation associated with the cathartic or enema habit, as well as an anxiety neurosis on the part of the patient. Physical exercise is of value, the exercises which are mentioned being hill climbing, rowing, swimming, skipping, horse-back riding and certain Swedish movements.

THE INTESTINAL NERVOUS MECHANISM. Muller,² discusses the question of the intestinal nervous mechanism. The nerves of the intestinal tract may be divided into two groups. One is the external group, which includes the intestinal branches of the pneumogastric nerve, and the mesenteric colic nerves of the sympathetic and sacral autonomic nervous system. The second group consists of the internal nerves, which are plexus of nerves in the walls of the intestines themselves.

This author has investigated the internal intestinal nerves with the purpose of finding a basis for the movement of the bowel. He finds that the mesenteric plexus is differently constructed in the stomach and in the intestines. For instance, in the stomach the plexus consists of typical vagus cells, the submucous plexus of *squalus acanthias* contains mainly sympathetic cells and, to a lesser degree, vagus cells. The mesenteric plexus consists entirely of vagus cells. In the musculature and the mucous membrane of animals, sympathetic cells were found. In the small intestine the mesenteric plexus consisted in an equal proportion of vagus and sympathetic elements, while in the large intestine the sympathetic cells predominated. The intestinal submucous plexus consisted mainly of sympathetic cells.

These observations show that the nervous mechanism of the various parts of the digestive tract is not uniform, as Cannon and others have claimed. This author believes that both the vagus and the sympathetic cells have an antagonistic relationship. The vagus cells have a motor, and the sympathetic cells an inhibitory, effect.

ROENTGEN-RAY STUDIES OF THE LOWER RIGHT QUADRANT OF THE COLON. J. T. Case³ discusses the roentgen-ray interpretation of pain in

¹ Medical Life, November, 1921.

² Upsala lakaref. foch., Stockholm, September 1, 1921, No. 22, 36.

³ Northwestern Medicine, July, 1921.

the lower right quadrant of the abdomen. He discusses the histories of several cases which had undergone appendectomy, in which the principal indication for operation was the existence of chronic pain and distress in the lower right quadrant of the abdomen. In this discussion, mention is made of the roentgen-ray manifestations of the colon and the necessity of studying the entire colon. Particular stress is laid on the significance of right side colon retention as evidence of a disturbance of the distal colon. If one considers the movements of the colon, it is noted that the principal movements of the ascending colon are antiperistaltic, tending to keep material in the right side of the colon and the cecum; while the distal movements are more of an onward churning nature. If one examines the position and shape of the transverse colon, considerable alteration may occur without any onward movement in the colon contents. On the other hand, the chief propulsive factor in the large bowel is the spontaneous large contraction involving a considerable extent of the colon, and occurring once or twice in twenty-four hours. During this movement the haustral markings are lost, and the movement is sausage-shaped and rounded, and there are marked dislocations in the mass. The patient is oblivious of any sensation, and the markings are usually seen before or during evacuation. Case calls them "spontaneous mass movements."

The knowledge of these colon movements is extremely important in the interpretation of the roentgen-ray pictures of the colon. Pseudo-filling defects can be readily produced in the colon owing to its peristaltic activities. These errors are best avoided by supplementing the roentgenography by fluoroscopy, and by the combined *per os* and injection methods. Another point is the frequency of right-sided retention, which has nothing to do with bands or adhesions, but which in reality is associated with trouble in the distal colon. More commonly, the obstruction is functional or spastic in character. In a number of cases, however, adhesions to the pelvic loop, pressure of pelvic tumors, carcinoma, peridiverticulitis, incarceration of a prolapsed and redundant pelvic colon, rectal lesions, such as hemorrhoids, fissure, rectal ulcers, proctitis and rectal atony are responsible. Not infrequently, a point just proximal to the midline in the transverse colon has been held as the seat of obstruction, but the studies of certain observers would indicate that this is the zone where antiperistalsis ceases. Obstruction may be simulated by the disposition of the opaque mass after defecation, owing to the fact that normally the colon, up to the splenic flexure, is alone evacuated.

It must therefore be borne in mind that in many individuals the right-sided discomfort is cecal or colic and not necessarily appendiceal, which accounts for the dissatisfaction which attends some of these cases following appendectomy.

EXAMINATION OF THE FECES. *Clinical Value of the Quantitative and Qualitative Estimation of Fats.* While functional testing of the upper digestive tract is complete regarding the proteins and carbohydrates,

Ramos¹ states there exists considerable difference of opinion regarding the fats. Of the fats eliminated in the feces, 4 to 5 per cent of the whole fat ingested are represented in this way; 25 per cent are neutral fats, 38 per cent are fatty acids and 37 per cent are soaps. His patients are put on an exclusive milk diet for four days; the fat, protein and carbohydrate content of the milk being known, the feces were then examined for the total amount of fat, as well as the type of fat present. If the total fat was in excess of 5 per cent, two classes of functional disturbances were found; either exaggerated peristalsis or steato-dyspepsia. The presence of an increase in neutral fats alone, indicates entero-hepatic and pancreatic deficiency; the presence of fatty acids and soaps in excess of 75 per cent shows an incapacity for fat absorption due to the presence of lesions, usually ulceration, or atrophy of the intestinal mucosa. The presence of fatty acids increases the acidity and extends the ulceration and irritation of the mucous membrane. In this connection, it might be well to point out that the presence of split, but unabsorbed, fat would indicate intact pancreatic but insufficient biliary function.

CONSTIPATION. Panchet² describes two forms of constipation; one which is terminal, left-side, dyschezic, with fecal evacuations often old and dried out involving the distal segment of the colon. This form is only slightly toxic in its action. The other is right-sided constipation; proximal or ileocecal with liquid stasis, septic, and almost always producing some of the signs of intestinal stasis. The terminal or left-sided variety requires medical treatment. Dyschezia may be the result of a congenital anomaly, rectal spasm, bad habits, or a combination of the three. The savage has three movements a day, reacting to a postprandial movement after meals. Mineral oil should be used regularly at beginning or during each meal. Regarding the operations for right-sided constipation; cecoplication, cecosigmoidostomy and iliosigmoidostomy, and partial or total colectomy in one to two sittings are indicated.

PHYSIOLOGY OF THE FATS AND LIPOIDS.³ In a voluminous article of over 400 pages, Goiffon, in the *Archiv. des Maladies de l'App. Digestive*, reviews the important points of interest to the physician. Within recent years so much attention has been paid to the protein family that a treatise on the fats is urgently necessary.

All the fatty acids of the organism can be divided into two parts. One is fixed and uniform in all individuals of the same species. This form is more or less constant, while the other form is variable, and this second form is the reserve of fats in the organism. It is the latter alone which disappears on starvation, and which is distributed in the muscle and cellular tissues throughout the body. On the other hand, the liver had a more or less fixed fat content, regardless of the richness of fat in the dietary.

The digestion of fats has nothing to do with gastric secretion (except the liberation of fats by digestion of protein substances). Furthermore,

¹ Cron. Med. Chir. de la Habana, January, 1922, p. 167.

² Policlinico, Rome, January 15, 1922, p. 291.

³ Annales des Sci., Naturell Zoologie, 1921, t. 4, 1-6.

the true intestinal secretion contains a lipase of little activity, playing a very minor role in fat digestion. On the other hand, the pancreatic and biliary secretions are the important agents in fat absorption; the pancreatic secretion by its double action of emulsification and saponification; and the bile by its ability not only to accelerate the saponifying action of the pancreatic juice, but also to dissolve the products formed. It is, however, the absence of bile which produces the greatest deficit in the absorption of fats. The exclusion of the pancreas always makes itself felt by a very marked loss, some 50 per cent, but it is remarkable to note how little the pancreatic secretion is necessary to a good absorption of fats. Brugsch noted, for instance, in subtotal ablation of the pancreas that it required but a small part, 2 to 3 cm. by $\frac{1}{2}$ cm., in size of functioning pancreas to produce absorption of the fats of milk to the extent of 80 per cent.

According to Terroine,¹ all the fats are NOT EQUALLY saponified by the pancreas with equal rapidity. The following are the points which he brings out:

1. The facility with which the pancreatic secretion attacks the fats is dependent entirely on the composition of the fatty substances, and also their fusion point.

2. The natural fats constituted especially by the glycerides of the saturated fatty acids are more easily saponified than those rich in trilaurine and the neighboring glycerides.

3. The natural fats constituted especially by the glycerides of high molecular weight are more easily saponified than those rich in trioleine.

Regardless of their digestibility *in vitro*, six hours after the ingestion of fats, the fats with high iodine index—such as lamb, chicken, squab—are much more readily digested than those of low iodine index (mutton, veal, pork). The oils follow the same law.

The blood content of total lipoids, that is to say both the fatty acids and cholesterol, is very different in different normal subjects of the same species (dog). Likewise, the relationship or coefficient of cholesterol fatty acids shows marked differences. On the other hand, the same animal will show a marked constancy in the lipid content of the blood; or the lipemic index and the coefficient cholesterol fatty acid; or the lipemic coefficient. According to Bloor and Bang, there exists normally a lipemic constant "*constante lipémique*," which is defined by the two values; the lipemic index and the lipemic coefficient.

The lipemic constant is more or less fixed in the same way that the glyceic constant is fixed. Such a situation demands, of necessity, the existence of regulator mechanisms. In the course of the absorption of fats, an increase in the fatty acids of the blood is observed, which reaches its maximum some six hours after a meal. Furthermore, in the course of the absorption of fats, an increase in blood cholesterol is observed.

In the course of starvation, variations in cholesterol follow those of the fatty acids, but the coefficient or relationship between these two substances does not remain constant. The administration of phlorizine,

¹ Abstract: Archives. des Mal. de l'App. Digestiv, 1922.

in animals subject to prolonged starvation, does not result in any increase of the fats in the liver; but it increases regularly with one exception—an increase in the fatty acids of the blood. Here, again, the variations in blood cholesterol do not follow those of the fatty acids.

After frequent and abundant bleeding, the serum seems to maintain its constant in total lipoids and in the cholesterol fatty acid coefficient. On the other hand, the suprarenal capsules which contain the normal amount of fatty acids contain a quantity of cholesterol four times less than that of a normal animal.

The sum total of these facts would lead us to believe that when the blood is deprived of its proper lipoids, a regulator mechanism exists, which tends to rapidly restore the indices and normal coefficients regarding fats in the blood-serum. We mention these findings only inasmuch as they throw some light on the pancreatico-biliary system in its true relationship to fat metabolism.

CHRONIC ULCERATIVE COLITIS. Yeomans' study is based on the observation of 65 cases of chronic ulcerative colitis of unknown etiology, of which those due to parasites, tuberculosis, syphilis and other recognizable causes are excluded.

The disease, according to the author, is characterized by an acute or gradual onset, usually between the twentieth and fortieth years of life. Ulceration of the colon is the essential pathologic condition, and dysentery (either continuous or with remissions) is the cardinal symptom, and may run a protracted course of many months or years, and cause a guarded prognosis to be given.

From the history, no definite cause could be assigned in 37 cases. In 5, there was a history of amœbiasis, but no amœbas or cysts were found; the onset dated from dietary indiscretion in 6 cases, severe constipation in 5, exposure in 3, injury, pyorrhea, root abscesses and pregnancy, 2 cases each. It followed parturition in 1 case, and a surgical operation in 3 cases. Search for *Bacillus dysenteriae* (Chiga, Flexner) amœbas, cysts, ova, parasites, tubercle bacilli and flagellate bodies was negative. Stained smears from the stools and direct from the ulcers showed the usual flora. Cultures from the same sources grew *Bacillus coli* regularly, together with various strains of streptococci and staphylococci. The author quotes Kendall who claims that normal bacteria may, through unusual conditions, multiply with abnormal luxuriance, and eventually lead to reactions within the host which may be injurious. Among such "unusual conditions" are food toxins, severe constipation, injuries, surgical operations, pregnancy and labor, all of which temporarily lower normal resistance. Favoring a theory of infection, however, is the fever and prostration often present at the onset, and later septic complications, especially arthritis. Pathologically, the process is simple chronic ulceration. The following were the findings in this series of cases:

(a) Superficial discrete ulcers, large or small, 20 cases.

(b) General superficial ulceration and granular areas, 20 cases.

¹ Journal of the American Medical Association, December 24, 1921, No. 26, 77, 2043.

(c) Large irregular chronic ulcers, with grayish necrotic base, the intervening mucosa being apparently normal, 9 cases.

(d) Deep hemorrhagic ulcers, 4 cases.

(e) Deep, moth-eaten, closely-set ulcers, 2 cases.

(f) Superficial irregular ulceration and granulation, limited to rectum and sigmoid, 10 cases.

Secondary complications were polyps (4 cases), rectal stricture (1 case) and arthritis or joint pains in 4 cases.

Symptoms. These were gradual in 47 cases, and acute in 18 with diarrhea, and in 9 cases an elevation of temperature. The number of stools varied from 3 to 20, the average being 7, and occurred mainly in the morning and evening and seldom at night. Ten patients were constipated. The discharge consisted of blood alone in 10 cases, blood and mucus in 19, blood and pus in 12, and blood, pus and mucus in 15. Blood predominated or was present in 86 per cent of the patients.

The average weight loss was $19\frac{1}{2}$ pounds, the greatest being 80 pounds, while 25 cases showed less than 10 pounds loss. Blood count was under 4,000,000, and in those showing marked bleeding the hemoglobin index was 55 to 90 per cent, and leukocytes varied from 9000 to 29,000. The average eosinophile count was 4 per cent. Gastric findings, when performed, were normal or subnormal. Urinalysis was negative, except for a regular increase in indican. In the majority of cases there was prostration.

Intestinal colic and urgency before bowel action is rather characteristic, according to the author, and not infrequently there is a sensation of abdominal unrest and tenseness. Abdominal tenderness is notable only when there is perforation or peritonitis complicating colitis. The sigmoid colon can usually be felt as thickened, and pressure on it excites the desire to defecate.

The *diagnosis* is made by the history, the laboratory examination of the stools, sigmoidoscopy, and roentgen-ray examination of the colon. The sigmoidoscope enables us to examine the bowel directly, and obtain material for laboratory examination. Roentgen-ray studies should include the chest for latent tuberculosis.

In the roentgen-ray studies, non-haustation and contraction of the colon are pictures more or less characteristic of this condition; and a thorough roentgen-ray study will indicate the extent and type of the pathology.

The *prognosis* should be guarded, depending on the duration of the disease and the extent of coöperation of the patient with the physician. The diet should be mixed, nutritious, and thoroughly masticated, excluding both highly fermentative articles and those which are likely to leave and irritating residue.

The drug *treatment* includes the usual tonics and antiseptics, including arsphenamine, emetine, yeast and Bulgarian bacilli, the last by mouth, by colonic implantation and through appendicostomy. Local treatment consists of irrigations, instillations, and topical applications through the sigmoidoscope. Instillations to be retained over night of

warm olive oil or liquid petrolatum, with bismuth or orthoform and 1 to 2 per cent argyrol solution, are very beneficial, as is aqueous extract of krameria. Irrigating solutions vary from plain water, salt solution, solutions of boric acid, sodium bicarbonate, hydrogen peroxide, potassium permanganate, quinine, chloramine-T and silver nitrate. Auto-genous vaccines were used in 10 cases, *Bacillus coli communis* was used in 5 cases, and *Bacillus coli* and *Staphylococcus albus* in 5 cases.

In 3 of these cases the effect of the vaccine was prompt and 3 others were markedly improved. It is likely, as the author mentioned, that the usual intestinal contents can secondarily infect the ulcerations. Transfusion of blood was done in 3 cases, with marked improvement in 2 of the cases. Surgery, in this author's opinion, is only indicated where the above measures have failed. Irrigations through appendicostomy cured 3 patients and markedly improved 1 of the 7 patients submitted to this procedure. Ileostomy is preferable and even more efficient, but it has the objection of a fecal fistula which must be closed later. The author gives as the indication for colectomy, involvement of the entire colon and all its walls, so that the organ is practically converted into a pus tube. Three of the authors patients died, 2 having been treated medically and 1 surgically.

The author's summary is as follows: 1. Chronic ulcerative colitis is a serious disease, its victims often passing through many hands before its true nature is recognized.

2. By the use of modern instruments of precision and laboratory tests, its diagnosis is simple, as is its differentiation from other lesions which cause similar symptoms.

3. Until and unless a special or specific microorganism is isolated as the causal agent—a rather unlikely probability—the treatment is symptomatic and empiric.

4. Treatment in the vast majority of cases is medical at first; this failing, surgery is indicated.

5. There is need of further observation and reports of large series of cases and serious study, especially on bacteriologic lines, by staining of tissues and cultures, to elucidate, if possible, the obscure problem of its etiology.

DIVERTICULA, DIVERTICULITIS AND PERIDIVERTICULITIS OF THE SMALL INTESTINE, CECUM, COLON, SIGMOID FLEXURE AND RECTUM. A diverticulum, according to Gant,¹ is a non-neoplastic outpouching of the intestine, having a lumen which does, or did, connect with the bowel. Diverticulitis is an inflammation of a diverticulum, and peridiverticulitis is an inflammation of the structures surrounding the sac. Diverticula may be congenital or acquired, the former being divided into true diverticula (compressing all the layers of the bowel wall), and false diverticula (in which several layers have given way allowing the mucosa to pouch outward). Occasionally true diverticula become false. Rare in the appendix, duodenum and jejunum, diverticula occur occasionally in the ileum, are common in the cecum and very frequent in the descend-

¹ Journal of the American Medical Association, October 29, 1921, No. 18, 77, 1415.

ing colon and sigmoid. Acquired diverticula are most common at the mesenteric border and the sites of the appendices epiploica. In about 50 per cent of cases, symptoms are absent. In 13,068 autopsies, diverticula were discovered 83 times, of which 39 were congenital and 44 acquired or false.

Etiology. Age, weakness, weakening of the intestinal musculature and chronic constipation, complicated by gas and fecal accumulation, are predisposing causes. Furthermore, the condition occurs twice as frequently with men as with women. Wasting diseases, tuberculosis, colitis, etc., favor its formation; hemorrhagic infarcts, worms, foreign bodies, obesity, ulcerative colitis, dilated intestinal glands and new growths are given as causes.

Pathologically, congenital diverticula are usually found in the small bowel, while acquired diverticula may vary from the size of a pea to a hen's egg, and may number from 1 to 100 or more. Diverticulitis and peridiverticulitis may occur with thickening of the walls and connective tissue infiltration of the sac. Perforation, adhesive formation and bowel obstruction may occur, and fistula formation into other portions of the bowel, vagina, bladder, and even the surface of the body.

Small intestinal diverticula (excepting Meckel's) rarely become inflamed, but 25 per cent of the colonic and sigmoidal pouches undergo secondary changes with definite manifestations. At first, digestive discomfort and abdominal uneasiness, with probably constipation and gas formation, occur. Later, there may be obstinate constipation alone, or alternating with diarrhea, fecal impaction, and pain in the sigmoid region; and, finally, if the bowel is occluded there is marked fecal retention, pain, rigidity, leukocytosis and fever; and if the diverticulum is infected, mucus, pus and blood in the stools. Perforation gives the usual signs of spreading peritonitis, with localized pain and swelling if abscess formation is present. The tumor may vary between the attacks, owing to the temporary relief of gas, pus or feces.

Diverticulitis and peridiverticulitis must be differentiated from neoplastic tuberculosis, chronic appendicitis, actinomycosis, intestinal obstruction, carcinoma, chronic sigmoiditis, fecal impaction, encysted foreign bodies, disease of the adnexa, chronic abscess, fistula and vesical tumors.

One is justified in making the diagnosis if there is a history of left-sided inflammation with periodic exacerbations, and an absence of marked cachexia, and loss of weight.

MALIGNANCIES OF THE COLON. Erdmann and Carter¹ discuss this subject from their large experience in the Post-Graduate Hospital where 129 cases came under their observation in the last six years, 15 of which were inoperable owing to metastases to other organs and 9 of which were inoperable owing to extensive regional metastases. The remaining 105 cases were operated on with various types of palliative and radical operations. In fact, in their series, malignancy of the colon occurred more frequently than carcinoma of the stomach.

¹ New York Medical Journal, June 7, 1922, p. 649.

The following is given as a classification of the sites of frequent occurrence:

1. In the inferior division of the inferior mesenteric distribution from the anus to the sigmoid including the so-called sigmoido-rectal junction. This series represented 50 out of a total of 129.

2. In the superior division of the inferior mesenteric or the sigmoid zone proper, 37 cases.

3. The ileocolic region or the cecum and the terminal ileum, 18 cases.

4. The midcolic region considering this area to include the upper half of the ascending colon, the hepatic flexure and the descending half or rather the proximal half of the transverse colon, 15 cases.

5. The distal colic region including the distal half of the transverse colon and the descending colon, 9 cases.

Regarding sex distribution, of 86 cases at the Post-Graduate, 46 were males and 40 females. In the sigmoid there were 10 more males than females and in the recto-sigmoid and recto-anal, there were 10 more females than males. The average age of operable patients was a little over forty-nine years. Regarding the question of rapidity of growth, it was remarked that the more youthful the patient the more rapid the growth.

Regarding the symptomatology, this varies somewhat with the situation of the growth. In the cecum and ileocecal region, it was noteworthy that none of the patients showed obstruction, probably owing to the fluid condition of the bowel contents. These cases show early and pronounced anemia, and are often palpable. The roentgen ray, according to these authors, is not as conclusive as for growths in the distal half of the colon. These patients rather complain of distress, soreness, and pressure at that point to such a degree as to arouse the suspicions of a recurring appendicitis. Not infrequently they are operated upon for supposed appendicitis and the true state of affairs is overlooked by the operator. This occurred in this series in 5 cases. Colic occurs in proportion as the growth tends to occlude the lumen and in proportion as the contents tend to assume the solid state. Toxemias, however, are seen more often in obstruction of the distal half.

Regarding the question of pain, occasionally these are of sciatic, lumbar, and perineal type due to nerve involvement. Tenesmus is a common symptom in cancers of the lower portion of the gut. Pain in the back, a sense of incomplete defecation, blood or mucus, or both, in the stools, anemia, emaciation, and cachexia are all symptoms pointing to the possibility of colon cancer. In the rectal region with, or without, infiltration, there may be sphincter failure. When there is sharp pain without emaciation or a long history of tenesmus, mucous or bloody stools, it rather points to perforating diverticulitis than malignancy.

After discussing the surgical aspects of the case, the authors report the following end-results: (1) Extension of life with no foul discomforts in those patients with existing metastases in the liver at the time of operation was from eight to twenty-four months or more.

2. In those with no appreciable metastases in remote zones extension of life was from months to years. In tracing these patients, they found there were several living in each group from one to six years.

3. Regarding radium, the authors are not optimistic and mention the fact that in the majority of cases the use of radium has not only been negligible but even deleterious.

They consider the proctoscope and the roentgen ray of inestimable value. Patients with the above symptoms should be carefully submitted to the above procedures and roentgen-ray examination made both by enema and by the opaque meal by mouth.

Andresen,¹ contributes an interesting and timely article on *acute intestinal obstruction*. He points out the fact that this condition is a serious one and even in the hands of the best surgeons, the mortality rate averages over 40 per cent. The mortality from strangulated hernia, in which the cause is more obvious probably averages 25 per cent. But all statistics agree that the mortality rate is lower the earlier the operation after the onset of symptoms. McKenty, for instance, in 43 cases with an average mortality rate of 40 per cent had an operative mortality of only 11 per cent when the operation was performed within the first twenty-four hours after the onset of symptoms. In the second period from twenty-four to forty-eight hours, it was a little over 22 per cent; in the forty-eight to seventy-two hour interval it was 50 per cent, and after seventy-two hours, almost 70 per cent died. Richardson, in his study of 118 cases by twenty-three surgeons of the Massachusetts General Hospital, found a mortality of 41.5 per cent, with 32.5 per cent in those patients operated on in the first forty-eight hours following the onset of symptoms.

It was Moynihan who said that anything over 10 per cent is the mortality of delay. This delay is obviously due to several causes, among which might be mentioned, self medication by the patient, inability of the average medical man to make a sufficiently early diagnosis, and the fact that the average medical man will often wait for the classical text-book description, with fecal vomiting, visible peristalsis, hippocratic facies and collapse, symptoms many of which indicate that the patient is beyond the possibility of cure.

The author divides cases of acute intestinal obstruction into two groups: (1) Cases of acute obstruction following a more or less long-continued period of abdominal or digestive symptoms, such as partial obstruction, due to deformities, bands, or adhesions whether congenital, postoperative, or tuberculous; slowly developing obstruction from external pressure, ulceration, new growths, or diverticulitis or from long-continued gall-bladder irritation with the passage of the stone and not infrequently intestinal impaction of the stone; foreign body or fecal impaction and even paralysis of the bowel from acute local or general peritonitis. (2) Cases in which the acute obstructive symptoms come one suddenly without previous symptoms, such as volvulus, intussusception, internal hernia, or mesenteric thrombosis.

In all cases, the pathology is the same, namely, an occlusion of the intestinal lumen, interference of the circulation, which may result in gangrene, perforation, or peritonitis.

¹ New York Medical Journal, June 7, 1922, p. 653.

The cause of poisoning has not been satisfactorily explained. Dragstedt has shown that toxic substances form even when all secretions and food are removed before the loop is occluded. The fresh secretions are not apparently toxic but, on standing, the bacterial growth which develops in them is highly toxic. Davis and Stone have shown that if the isolated intestinal loops are allowed to drain even in the peritoneal cavity, no untoward symptoms develop. Dragstedt found that if these loops were washed with sterile water and ether, one-half of the experimental animals survived the operation whereas all the animals died if this procedure was omitted. He believes that it is impossible to sterilize the intestinal mucosa by chemical antiseptics, even when applied directly to the mucosa and believes, contrary to Whipple, and others, that the mucosa of the alimentary tract does not elaborate an internal secretion necessary to life, nor a secretion disturbed by acute obstruction which produces proteose, but that the substances accountable for the toxemia of acute obstruction are produced by the action of intestinal bacteria on proteins or their end-products, while the resulting injury to the intestinal mucosa greatly facilitates their absorption.

The *symptoms* of acute obstruction which are almost constantly present are vomiting, constipation, and abdominal pain. The vomiting at first is due to pylorospasm, but is not relieved by lavage and may occur immediately after the ingestion of food or drink especially in high obstruction. With lower forms of obstruction the vomiting may be delayed for a time. On the other hand, in two to four days after the pyloric sphincter is played out and fatigues, reverse intestinal peristalsis sometimes from all the way down to the ileocecal sphincter may occur.

Constipation is not always so clear, and the patient may have had a movement on the day before. Enemas which, in the beginning, may bring a slight fecal return, may return clear and no flatus is expelled. If the obstruction is low down but little of the enema is retained, if high up the whole enema may be retained. In intussusception and carcinoma, blood may occur in the washing or may occur spontaneously.

Pain is usually a prominent symptom and may occur all over the abdomen, although it usually occurs in the midabdomen. It is of cramp-like character, with severer paroxysms associated with reflex vomiting. The severe pain due to contraction of the musculature above the obstruction is aggravated both by food and cathartics and is not relieved by enemas. It is usually worse after the obstruction, tending to become less as the intestinal musculature tires out. Tympany is rare in the early stages and is really a late symptom; visible peristalsis is likewise rare, except in postoperative cases. Shock, as well as rapid pulse, are both rare at the onset but tend to appear as the disease goes on, being indications of strangulation, gangrene, and peritonitis. Palpable mass may be felt with carcinoma, impaction, and intussusception. The temperature may be normal until peritonitis supervenes.

Moderate leukocytosis occurs in many cases, but marked leukocytosis only occurs in later stages. Blood chemistry shows in the later stages an increase in blood urea.

The *diagnosis* is best made on the finding of: (1) Peristaltic pain

increased by food or cathartics; (2) persistent vomiting not lessened by lavage; (3) constipation unrelieved by enema. In early cases where the question of whether there is true intestinal obstruction or simply fecal impaction, the author feels justified in giving an oil enema (castor oil and olive oil—four ounces of each) or even a moderate dose of castor oil by mouth followed by a soap-suds enema and possibly a hypodermic of pituitary extract. In simple impaction or paresis this usually brings results, but if no evacuation occurs and symptoms are aggravated the diagnosis of obstruction should be considered as fairly well established.

The author gives the following conditions which must be differentiated from acute intestinal obstruction:

1. Acute peritonitis, from any cause in which the history, high leukocytosis, and rigidity are aids.

2. Gall-bladder colic, in which localization and sudden onset and cessation of pain with fever and icterus aid in the differentiation.

3. Renal colic in which the location of the pain, the urinary and roentgenographic findings are distinctive.

4. Acute poisoning from food or any other agent, with a history of having taken the irritant, with diarrhea, are important.

5. Pyloric stenosis, in which slow onset, delayed vomiting, and roentgen-ray findings make the diagnosis.

6. Acute hemorrhagic pancreatitis, which is difficult to differentiate but in which the symptoms call for the same treatment, immediate operation.

7. Uremia, in which edema, with urinary findings, and blood findings should enable one to make the diagnosis.

8. Lead colic in which the chronicity, history, and associated muscular weakness are of value.

9. *Angina pectoris and the crises of tabes in both of which the pains are not as persistent and do not last as long.

10. Gastro-intestinal purpura and angioneurotic edema which clear up rapidly.

TRANSFORMATION OF THE INTESTINAL FLORA. Bass¹ states that the meconium of the new-born child is sterile. Soon after the mother's milk has gained access to the digestive tract, a mixed series of organisms appear, giving way to a simplified flora consisting chiefly of the *Bacillus bifidus*, which persists as long as the child's diet is mainly breast milk. Another organism was claimed to be the predominating organism in nursing stools, but it is now generally acknowledged that the *Bacillus bifidus* is the most prominent. *Bacillus bifidus* is an anaërobe, while the *Bacillus acidophilus* is facultative. When, however, a new diet is inaugurated (particularly after cow's milk) *Bacillus bifidus* becomes less numerous and *Bacillus acidophilus* more numerous. Only for a time is the fecal flora of the young child dominated by the *Bacillus acidophilus*; as time goes on it gradually gives way to many other types, so that in the flora of normal adults the percentage is from 0 up to 5 or 6 per cent of *Bacillus acidophilus*.

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¹ Annals of Medicine, July, 1922, No. 1, 1, 25.

Interesting are the various conjectures regarding intestinal bacteria. In 1868, Senator declared that decomposition of proteins within the alimentary tract resulted in the formation of substances toxic to the host. Twenty years later, Bouchard elaborated the theory of intestinal intoxication. Metchnikoff believed that premature senescence was the result of bacterial activity in the intestinal canal. This gave rise to the indiscriminate use of the *Bacillus bulgaricus*, but, in 1908, Herter and Kendall demonstrated that the *Bacillus bulgaricus* cannot survive in the intestinal canal of animals. Their experiments were on the monkey. Distaso and Schiller, in 1914, found the same thing with white rats, and Ralie, in 1915, confirmed these observations. Finally, Rettger and Cheplin found it impossible to recover *Bacillus bulgaricus* from the feces of man after feeding with the organisms.

Diet has been shown to have a profound effect on intestinal flora. Herter and Kendall found rapid alterations in the intestinal flora of both cats and monkeys when a diet of meat and eggs was followed by one of milk and dextrose; there being a substitution of an aciduric non-proteolizing type for one which was formerly strongly proteolytic. As the food varies, so will also the bacteria vary. Hull, Rettger, Distaso and Schiller observed the profound effect of lactose in changing the flora of animals from a putrefactive to an aciduric type. Torrey, in 1915, found that it took 250 to 300 grams of lactose a day to transform the fecal flora of typhoid patients from the usual mixed type to that dominated by the *Bacillus acidophilus*. Finally, in 1921, Rettger and Cheplin published a monograph on the subject of intestinal flora, in which they emphasized the fact that when either lactose or dextrin was fed in addition to the usual diet to the amount of 2 grams daily, a progressive increase in *Bacillus acidophilus* could be noted in two days, reaching its maximum in four to eight days. As the *Bacillus acidophilus* increased, the gas-forming putrefactive bacteria decreased, and finally disappeared. With men, 300 grams of lactose or dextrin, daily, cause practical elimination of all other bacteria except *Bacillus acidophilus*, while smaller amounts (150 grams or less), although increasing the *acidophilus* population, failed to make any noticeable impression on the other bacteria present. On the other hand, from a practical viewpoint the *Bacillus acidophilus* was fed by mouth. Sometimes 500 cc produced complete transformation, while in others 1000 cc daily was necessary. Again, when reinforced with lactose, smaller amounts of the culture gave practically the same results as large quantities. For instance, 500 cc of the culture plus 150 grams of lactose produced practically the same effects as 1000 cc of the culture or 300 grams of lactose. Bass studied the effects on men of *Bacillus acidophilus* milk cultures, using 1000 cc a day, with a complete change in the fecal flora. Out of curiosity, Bass examined some of the commercial preparations and none of the commercial tablets contained as many as 1000 viable bacteria. It would therefore take 1,000,000,000 tablets, or some twenty tons of tablets, to contain as many bacilli as are contained in the 1000 cc of *Bacillus acidophilus* milk. All the observer needs is fresh cultures of the organism which should be inoculated into sterile milk, using relatively large quantities, some 10 cc or more to the liter.

Gompertz and Vorhaus¹ discuss the question of the *Bacillus acidophilus*, its bacteriologic characteristics, the preparation of media and the possibilities of this form of therapeutics. The main points mentioned by Bass are reviewed and the following directions are given for preparing cultures:

These observers gave *Bacillus acidophilus* cultures in both chronic constipation and diarrhea, with material improvement. Of 50 cases of chronic constipation, 42 gave good results, and in 10 out of 12 cases of chronic diarrhea improvement was noted.

When the administration of the culture ceases, the *Bacillus coli* begin to increase, slowly at first until the fifth or sixth day, at which time they again present the predominating type of bacteria. If lactose or dextrin is included in the diet, this transition may be retarded considerable.

At first fermented milk was given. This was prepared by inoculating sterile milk with *Bacillus acidophilus* and allowing it to incubate at 37.5° C. for from forty to fifty hours. Either whole or skim milk may be used. The dose is from a pint to a quart daily given preferably before meals in amounts ranging from one-half to one tumblerful. This method, however, proved to be inconvenient from a practical standpoint, thereby necessitating a different means of administration. A broth culture in which this bacillus grows luxuriantly, giving the optimum concentration, was finally used.

The broth is so prepared that each cubic centimeter contains 100,000,000 *Bacillus acidophilus* organisms and the dose is from 10 to 20 cc either two, three or four times a day, before meals, depending entirely upon the response of the individual.

The technic of preparation of the broth is simple, and is as follows:

1. To 1000 cc of distilled water add 4 grams Liebig's meat extract, 10 grams peptone (Merck's) and 5 grams sodium chloride B NaCl.
2. Heat over free flame until thoroughly dissolved, stirring constantly.
3. Titrate and adjust to required reaction p_H 6.9-7.0 neutral.
4. Sterilize in one-liter flasks for one hour in Arnold sterilizer.
5. Filter bouillon *cold* the next day through filter paper, until clear.
6. Add to clear bouillon, to 1000 cc 50 grams of lactose; 5 per cent; shake well, until sugar is dissolved.
7. Pour media in flasks (300 cc) in one-half liter flasks.
8. Place the flasks stoppered with cotton in the autoclave for *twenty-five minutes* and sterilize at 15 pounds pressure.

These flasks are then inoculated and incubated at 37.5° C. for about sixty hours. They are then removed and the clear supernatant fluid is decanted. This simple procedure gives approximately a concentration of 1,000,000,000 bacilli to each cubic centimeter. The culture is then distributed in sterile 8-ounce bottles and kept cool until used.

In this medium *Bacillus acidophilus* grows luxuriantly, although growth is not perceptible until the end of forty-eight hours. This fact is of considerable practical importance, for it affords a simple and yet accurate means of determining the purity of the growth. The

¹ Annals of Medicine, July, 1922, No. 1, 1, 33.

usual laboratory contaminants, which are the *Bacillus subtilis* and *Staphylococcus albus*, show a luxuriant growth in this medium at the end of twenty-four hours. Furthermore, these contaminants are more or less evenly distributed and contaminated flasks show a uniform density. The growth of *Bacillus acidophilus*, however, is a thick, heavy, slimy growth which settles quickly to the bottom and leaves a clear supernatant layer of bouillon above. Thus the contaminated flasks are easily detected and thrown aside.

The *Bacillus acidophilus* is Gram-positive, varying in shape from short to long rods. On lactose agar, it forms small, whitish-gray colonies with wavy margins. It grows slowly, being hardly perceptible at the end of twenty-four hours. This organism ferments milk, producing acid slowly so that the milk does not usually begin to sour until incubated for about thirty to thirty-five hours.

Choplin and Wiseman made a study of *Bacillus acidophilus* milk upon cases of chronic constipation. It was their purpose to determine the therapeutic value of acidophilus lactose milk on chronic constipation. This milk was prepared in accordance with the method advocated by Choplin and Rettger, in 500 cc amounts, and living twenty-four hour cultures were given to these patients daily. In most instances 500 cc of the milk were reinforced with 100 grams of lactose, and this quantity was ingested by the patients each day in two equal doses. This milk was given in addition to the ordinary diet, and during the period of investigation no laxative or cathartic was permitted.

Bacteriologic examination of the stools revealed in most instances a prompt response, and daily evacuations were recorded. In some cases it was necessary to double the quantity administered.

It is, therefore, evident from these observations that the tendency of acidophilus lactose milk was to regulate the intestinal movements and also to change intestinal bacteria. Within a few days these results were obtained, the mixed bacterial types giving way to a simplified flora in which the bacillus acidophilus predominated.

CHRONIC INTESTINAL INDIGESTION OF THE FERMENTATION VARIETY. Jankelson's¹ communication deals with the well-recognized fermentation type of intestinal disturbance. These stools are the large, bulky, light-colored stools with the acid reaction and sour odor. They are usually light-colored, distinctly acid to litmus, contain considerable undigested material, especially vegetables, and give a strong iodine reaction for starch. Occasionally it is possible to obtain an erythro-dextrin reaction of partially digested starch. Microscopic examination usually reveals undigested starch granules. The movements are acid owing to the acid of fermentation, particularly acetic and butyric acid. Disease is supposed to be due to the overgrowth of fermentative bacteria, and, when no carbohydrates are ingested, these bacteria simply starve out or become markedly lessened in number. These patients usually develop an early colitis and the chief complaint is persistent diarrhea, distention of the abdomen, rumbling, and even occasional

¹ Boston Medical and Surgical Journal, May 4, 1922, 186, 597.

nausea or vomiting. Later on there is no question but that a moderate degree of toxemia develops, usually dizziness, vertigo, headache, insomnia, irritability, and later a well marked neurasthenia.

The treatment consists entirely in starving out these bacteria by means of a pure protein and fat diet. Carbohydrate is then given in increasing amounts, but it is usually necessary to avoid vegetables and fruits for some months. In many of these cases it may be noted that there is enterocolitis and not infrequently a low grade catarrh of the entire digestive tract. (Reviewer.)

Norman and Eggston¹ discuss the important subject of pyogenic infection of the digestive tract. These authors report 3 cases exemplifying intestinal infections which were relieved by removal of focal infection and colon drainage.

In later years one of the most important advances in modern medicine has been the definite establishment of focal infection, particularly the evident infections which are freely accessible, such as the teeth, tonsils, sinuses, nose and throat. Less evident are the cryptogenetic infections, such as those of the appendix, gall-bladder, and the digestive tract. These authors are of the opinion that in many instances intestinal stasis or constipation is the result of intestinal infection. There is no question whatsoever that a removal of the upper foci of infection frequently results in failure as long as the intestinal condition is persistent. Direct autopsy observations of the intestinal tract, particularly of the colon, cultures of the feces, the mesenteric lymph nodes and the gall-bladder contents would indicate that they are all infected by the same organisms.

With pyogenic infections the treatment resolves itself into: (1) Drainage of the colon; (2) changing the biologic process by a rectal and oral implantation of the protective forms of bacteria; (3) by maintaining a normal bacterial flora in the bowel; (4) by the use of autogenous vaccine in selected cases; (5) by properly selected exercise to strengthen the abdominal wall and to stimulate lymphatic drainage.

Vanderreis² discusses the bacterial flora of the small intestine and cecum in adults under normal and pathologic conditions. This author uses the so-called cartridge and found that the small intestine was fairly free from bacteria during the fasting condition but was not absolutely sterile as is generally supposed. The upper part of the small intestine contains Gram-positive bacteria mostly of the lactic acid type, diplococci and Gram-negative bacteria of the *aërogenes* group. The middle portion of the small intestine showed a greater number of bacteria but with a reduction in the acid type of bacteria, and with an appearance of the general colon type as well as other Gram-negative organisms. As we go down the small intestine, the Gram-negative bacteria increase. The cecum contains the starch fermentating anærobes clostridia and bacteria which form the hydrogen sulphide. Of course, the diet greatly contributes to the flora. For instance, a predominance in the carbohydrate diet produces the lactic type of bacteria, but fermentative dyspepsia is often accompanied by a predominance of the

¹ New York Medical Hour, April 19, 1922, 115, 449.

² Berlin klin. Wehnschr., May 6, 1922, 1, 950.

Gram-negative bacteria. There is also in that condition a striking reduction in the number of organisms which ferment cellulose. Another interesting point is the statement that there is an increase in the number of bacteria in the upper small intestine with subacid and anacid conditions, and there is a diminution in the number of bacteria in the upper part of the intestinal tract with hyperacidity.

OBSERVATION ON LAMBLIA INTESTINALIS INFECTION AND ITS TREATMENT. Simon¹ gives a short clinical description of 8 cases of lamblia intestinal infection. In 5 of these cases there was no history of diarrhea, while in the other 3 cases the diarrheal phases occurred irregularly alternating with periods of constipation. Another point of interest was the fact that blood was not apparently a characteristic of these stools, a point which might differentiate them from the amoebic type. In almost every instance there was considerable abdominal gas, often producing cramp-like pain. Loss of weight was only recorded in 3. In 1 case there was an inflammatory condition of the gall-bladder, and duodenal intubation showed the presence of organisms of this type. In making the diagnosis one can be solely guided by the discovery of these organisms in the stool or in the aspirated secretions of the upper intestinal tract. As a matter of fact, the organisms inhabit for the most part the duodenum and the jejunum, and may even find their way into the biliary passages. The encysted forms, however, can be found through the whole intestinal tract, and, when studied by careful microscopic examination, usually show up in showers.

In recording the treatment, it is noted that both emetine and ipecac are of no value in this form of infection. In one case with transduodenal lavage with Jutte solution, the cyst promptly disappeared. In 6 of these cases, however, arsphenamine, according to the suggestion of Yakimoff, in 1917, was used, and in 1 case the drug was introduced directly through the duodenal tube. In each instance there was a prompt disappearance of the cysts from the stools.

Knighton,² discusses the possibility of these organisms in the biliary tract, and was able to demonstrate these organisms in the aspirated bile. He comes to the conclusion, however, that transduodenal lavage or duodenal drainage gives only temporary relief.

LAMBLIA ENTERITIS. While lamblia or Giardia were encountered in France before the war, the cases have multiplied since then, and systemic examinations of the stools have revealed a large number of cases. Deschiens³ has made a morphologic, clinical and experimental study of this condition and believes in the unity of the types of Giardia. The idea of dividing them into two species (9 intestinalis and 9 muris) is based on little variation in structure, and the fact that both present similar phenomena in infected cats would militate against this subdivision.

Mice and cats have been infected by the ingestion of human cysts, and 2 cats were infected by rectal injection of the living organisms.

¹ Southern Medical Journal, June, 1922, p. 458.

² Ibid., p. 457.

³ Thèse, Paris, 1921.

They provoke diarrhea and even fatal dysentery. Ulcerative and erosive lesions are found in the lower third of the ileum, and even massive exfoliation and hemorrhage.

According to this observer, gastric acidity does not prevent infection. The cats registered an acidity of free HCl, 2.5 per cent. Studies on 11 cases in man emphasize the persistency of the infection, and show in some cases chronic enteritis, and in others even dysentery.

TREATMENT OF HOOKWORM INFECTION WITH CARBON TETRACHLORIDE. Nichols and Hampton¹ used this drug for the treatment of hookworm infection in school children. The treatment is carried out in such a way that the stools were examined both before treatment, three days after treatment, and ten days later. Two-thirds of the worms were passed on the second day. This drug is given in doses of 10 to 20 drops to children three to four years of age, and is apparently an effective remedy against hookworms. It may even be used for the round-worm but is not as effective as some of the ordinary remedies. Children of ten years of age may be given 10 drops with safety, and the dose should be increased 2 drops for each year. An adult dose would be to add 50 to 80 drops. Chenopodium is soluble in carbon tetrachloride. A good mixture of one of the former to four of the latter should prove to be an effective remedy for the expulsion of round-worm, or *Ascaris lumbricoides*.

The following reasons are given for the use of carbon tetrachloride in hookworm infection: (a) Patient does not object to its taste. (b) It is not necessary to precede or follow it by a purge. (c) It is more effective than chenopodium and has not the depressing effect of that drug. (d) It is much cheaper than any other drug used for the purpose. (e) It can be obtained in a high state of purity. (f) Persons under treatment can follow their usual routine.

CONSTIPATION. Heisland,² in discussing constipation, mentions the fact that while a daily evacuation of the bowels is usually considered a normal phenomena, nevertheless many individuals defecate at longer intervals and seem to be perfectly normal. Some of these individuals should not alter their habits, inasmuch as the delay does not seem to be incommensurate with perfect health. The treatment of constipation by means of diet alone is successful in many instances if the patient will only stick to the proper diet.

In a general way, protein foods constipate, and vegetables and fruit are laxative, but with many individuals the latter act in the reverse fashion, and there seems to be no question but that a mixed diet is suited to the needs of the ordinary individual. In this paper it is suggested that bread made from fine flour be eliminated. The following is simply a suggestion: A glass of cold water on arising. For breakfast: Oatmeal not too well cooked, Graham or whole wheat bread, butter, coffee with cream and sugar, raw or cooked fruit and marmalade. For dinner: Fruit, two vegetables, corn bread, butter, milk, occasionally meat, and

¹ British Medical Journal, July 1, 1922, p. 8.

² Kentucky Medical Journal, March, 1922, 20, 194.

a dessert if desired. For supper: Corn bread, butter, one or two vegetables, syrup or fruit sauce, buttermilk.

Charles¹ discusses the treatment of chronic constipation. This author, in reviewing the cases of chronic constipation and their treatment, comes to the following conclusion: First of all there is a psychic form of chronic constipation. This occurs in individuals who obviously neglect to attend to the regular defecation, with the result that there is an undue accumulation of material in the rectum and the consequent blunting of the reflexes concerned in this act. With the individuals who are obviously of a hysterical type, psychotherapy may be necessary, but in most individuals it is a question of correction of diet and the regulation of habits. There is another form of constipation which is due to disturbance in the colon musculature and also to an obvious relaxation of the intestinal wall. Exercises and a properly regulated belt are indicated in this case. Another form of constipation is that of alimentary origin. In this group of cases the diet is not well balanced and may be insufficient, or there may be an excessive meat diet with insufficient residue to stimulate intestinal peristalsis; or, on the contrary owing to the excessive injection of vegetables, there may be an accumulation of too much cellulose in the bowel, hindering complete evacuation. The obvious relief for this condition is the proper regulation of the diet. There is undoubtedly a form of constipation due to secretory causes, causes which may be due to an increase in the gastric acidity or to an insufficiency of liver or intestinal secretion; and, finally, endocrine insufficiency.

There is also a mechanical form of constipation due to adhesive bands, tumors and even organic stenosis of the bowel, in which surgery is obviously indicated. Some of these cases are tuberculous or syphilitic, in which case proper medication is indicated. There is another form of constipation of purely intestinal origin, such as is seen in cirrhosis of the liver. In this group of cases the fault is probably due to the passive congestion as a result of stasis of the portal vein. Still another large group of causes of constipation are the chronic inflammatory group, and, finally, one might enumerate the group of intestinal disturbances which are purely due to nervous influences, some of them reflex in origin, some of them central, such as hysteria and psychasthenia, and, finally, those which are purely spasmodic and might have local reaction.

Ringer and Minor² discuss the good effects of the administration of calcium chloride in tuberculosis diarrhea. They had treated 30 cases with 5 to 10 cc of a 5 per cent solution of calcium chloride given by intravenous injection at more or less frequent intervals. In many of these cases the calcium was given simply as a palliative measure, but in all but 8 cases there was extensive disease of the lungs, and in 16 cases there was no possibility of recovery, even though the intestinal symptoms were improved. In giving this material, great care must be exercised in order that none of it escapes in the subcutaneous tissue where

¹ Jour. de Med. de Bordeaux, May 25, 1922, **94**, 295.

² American Review of Tuberculosis, p. 876, Abstract, Medical Review, July, 1922, p. 184.

it is apt to give severe pain and even cause necrosis. It also should be given slowly.

In 13 cases there was no benefit observed. In 1 case the number of movements was reduced from 5 to 1 or 2 a day, and codeine, which had previously been given to relieve pain, was discontinued. At first the effect of the injection lasted a month. After three months the interval was cut down to one of three weeks, and after twenty months it was reduced to one of ten days, and the dose increased from 5 to 8 cc. In another case, with considerable pain, had 3 to 5 movements a day even though 2 grains of codeine were given; the first injection removed all pain which never recurred, and the stools were reduced to 2 or 3 a day without the use of any codeine. Another case of severe diarrhea with considerable abdominal distress was greatly relieved by the injections.

The authors are optimistic as to the value of this treatment and believe that with the more refined methods the treatment may even prove curative if given early enough.

PERITONITIS.

The peritoneum represents that great serous membrane which insures a protective surface to the abdominal viscera and permits free play of these organs one on the other. Normally, the relationship between absorption and exudation is so balanced that even a small amount of free fluid in the abdomen means pathology. Peritonitis, almost always a bacterial infection, tends to be walled off by adhesion formation. The most common source of bacterial infection is directly from some intra-abdominal organ, such as the appendix, the intestines, the female generative organs, the stomach, the gall-bladder, the result either of trauma, disease or both. Although there is such a condition as chemical peritonitis, produced by the introduction of presumably sterile instruments in the abdomen or the contents of some ruptured ovarian cyst, nevertheless, Deaver¹ feels that even here the condition is probably infection due to lessened resistance on the part of the peritoneum. Hyperemia, exudation into the subperitoneal tissue around the lesion, soon followed by the exudation of fluid into the peritoneal cavity, are the steps in the elaboration of an ordinary case of peritonitis. Even sterile substances will induce irritation of the peritoneum, such as, for instance, blood, bile or urine. When present, they interfere with intestinal function, damage the walls of the bowel, and favor bacterial invasion of the peritoneum. In the presence of perforation with infected material, naturally an infective and irritative peritonitis will be produced.

Shortly after the inauguration of irritation and inflammation, disturbances occur in the rate of exudation and absorption. The absorption occurs through the bloodvessels and lymphatics. Fluid and soluble substances are absorbed by both sets of vessels, but acid substances, such as bacteria and animal cells, are almost exclusively absorbed by the lymphatics. On the other hand, according to Deaver, absorption by the

¹ New York Medical Journal, September 7, 1921, p. 257.

blood-stream constitutes one of the greatest perils of peritonitis. At times the area involved may be well walled off, the rest of the peritoneum being practically normal and more or less protected against its invasion. Diffusion is encouraged by body movement, and practically we attempt to lessen movement by putting the body at complete rest, and by means of the proper posture encourage the gravitation of noxious fluids to the lower and less dangerous portions of the peritoneal cavity. It is well known that peritonitis arising from the lower portions of the peritoneal cavity are less serious than those coming from the upper zones, because the greater activity of absorption in the diaphragm, in the upper portion, favors diffusion.

The most important bacterial flora in peritonitis are the *Staphylococcus albus*, colon bacillus, streptococcus, pneumococcus, typhoid bacillus and gonococcus. According to the author, great stress is laid on the protective influence of the *Staphylococcus albus*, which, according to Dudgeon and Sargent, is the first to appear and the last to disappear in peritonitis of intestinal origin. In the presence of abundant phagocytes and staphylococci at a site distant from the focus of infection, the prognosis is favorable; it is grave, but not hopeless, if some bacilli are associated with these organisms, and very grave if only a few phagocytes, few staphylococci, but numerous bacilli and streptococci are found. The importance of the colon organism is recognized, but it is realized that this organism, after it is present, multiplies rapidly and tends to overshadow other organisms present. Streptococcic peritonitis is more frequent in women, owing to its greater frequency in pelvic infections. When due to pelvic inflammations, it is often a retroperitoneal inflammation, familiarly known as concealed erysipelas. Another form of streptococcic peritonitis is encountered in which the condition is not due to any abdominal organ, but presumably by hematogenous infection, most frequently from some acute infection of the nasopharynx, such as the tonsils. Pneumococcic peritonitis is rare, and as a complication of pneumonia it occurs, according to Hertzler, in less than 1 per cent of all pneumonias. Gonococcic peritonitis is one of the most clearly defined types, generally arising from an infected Fallopian tube with early localization in the lower abdomen. The most frequent cause of peritonitis is, however, perforation of an abdominal viscus, and the organ which is the commonest offender is the appendix.

The symptoms naturally vary, depending on the type of lesion. In appendicitis, the initial pain is usually severe, owing to occlusion of the appendicular artery and subsequent necrosis. Later, when necrosis is complete, the pain may lessen, lulling the patient into a false sense of security. Pain often with chilliness, reflex nausea and vomiting, rigidity and exquisite tenderness of the abdominal muscles, the peritoneal picture of the patient with legs drawn up, superficial and costal breathing, and, finally, small, frequent, thin pulse—are symptoms too familiar to mention. The temperature, usually low at first, becomes higher, then abdominal distention and tympanities occur.

Deaver warns against the danger of purgation. Sixty per cent of his cases gave a history of purgation, and 72 per cent of these showed pus, abscess, gangrene or perforation.

Localization of the infection is, of course, important, and infections of the pelvis are less dangerous than those higher up. Naturally, the mesentery, and particularly the great omentum, are of great value in walling off a lesion, but the important point regarding the lesion *per se* is the question of the intactness of its endothelial lining and the virulence of the organism.

Regarding the time of operation, the author naturally agrees with immediate operation for perforation or acute obstruction, but states that "he who operates in a case of acute diffusing peritonitis after the first thirty-six to forty-eight hours with no evidence of a localizing point is, in the majority of cases, not serving the best interests of the patient." Again, "too thorough operation in peritonitis very often spells death. Peritonitis is dangerous directly in proportion to absorption. It is not the inflammation of the peritoneum which is fatal but the toxins which are absorbed from the products of inflammation which is fatal."

SPLEEN.

The Spleen and Digestion. Inlow.¹ For a long time it has been assumed that there was some relationship between the spleen and the pancreas. For instance, Besbokaia and Bellamy emphasize this fact, inasmuch as the latter considers the splenic internal secretion to be carried to the pancreas by means of certain elements in the blood-stream, and Herzen states that the pancreas of the dog deprived of its spleen exists in a state of complete and permanent atrophy. Mendel and Rettger, of Yale, concluded, from their work, that extracts of the spleen prepared when the organ was congested during digestion increased the proteolytic power of the pancreas, while the boiled pancreatic splenic extract was ineffective. They claimed, however, that the extracts of the pancreas of splenectomized dogs were not always free from trypsin. Prym, in 1904-1905, used permanent pancreatic fistulas in his investigations, and he came to the conclusion that the amount of proteolytic power of the pancreatic juice was not influenced in any recognizable way by splenectomy. Further observations on two dogs with permanent pancreatic fistulas were made by Lombroso and Manetta, in 1915. They believe that the three enzymes of the pancreatic juice do not vary in any way after the removal of the spleen, but that the amount of pancreatic secretion increases to a remarkable degree. The idea, therefore, of Schiff-Herzen, that the spleen during this active phase of congestion liberates a substance into the blood stream which transforms the zymogen of the pancreas into active trypsin, has therefore many investigators who would substantiate this theory.

On the other hand, there are others who are unable to prove it, and the present author in his summary gives the data concerning the pancreatic secretion before and after removal of the spleen on two dogs with permanent pancreatic fistulas secreting an inactive proteolytic juice. Removal of the spleen in this instance caused no constant changes in the enzyme content or the alkalinity of the pancreatic secretion.

¹ American Journal of the Medical Sciences, July, 1922, No. 1, 164, 29.

NEPHRITIS.

By H. RAWLE GEYELIN, M.D.

THE older text-books of medicine dealing with most, if not all, of the diseases known to medicine are being gradually relegated to the archives of the past and in their place we have the newer and more massive text-book commonly spoken of as "A System" of Medicine. Whereas the older text-books owed their authorship to one, or, at most, two men—the modern "system" is a compilation of medical knowledge brought together by the united efforts of many men—all of these men having had unusual experience in certain diseases or in certain groups of diseases. The striking additions to our knowledge of medical science which has been made during the past twenty years have necessitated this step, and at present it would certainly seem to be the best method of assembling medical knowledge for the benefit of the enquiring students of medicine.

The increasing number of these systems of medicine published during the past two years would seem to be an answer to a demand for them. Several of these systems are so painstakingly done—certain diseases so completely and masterfully presented, and accompanied by brief reviews of the current literature, that it would almost seem to be an unnecessary and gratuitous procedure to add any further critical reviews and condensations of current literature pertaining to any one disease such as nephritis.

Nevertheless, in the present article which deals with a review and critical consideration of the more important and interesting articles on NEPHRITIS during the past year, I shall aim to present not only the newer points of view of the more recent workers in nephritis, but will also attempt to correlate these points of view with what is definitely established in our knowledge of renal diseases in greater detail than is possible in the systems of medicine.

There have been many articles dealing with one or another phase of nephritis published during the past year which add little or nothing to our present knowledge of this much-studied disease. These articles are interesting merely as repetitions of well-known facts. To the extent that they amplify or confirm our present knowledge, they are of certain value but no attempt will be made to review them all. As is usually the case, there are fewer articles which add somewhat to our present knowledge of facts and fewer still which contribute any new facts. As compared with the epoch-making discoveries of Banting and Best in diabetes made during the past year, the advances made in the problems of nephritis are insignificant.

Tests for renal function, continue to interest the largest number of investigators. No important new tests for kidney function have been presented, most of the work being confined to elaboration and mathematical refinement of old tests or to the correlation of certain groups of functional tests with certain clinical types of nephritis.

It is more than ten years ago since Rowntree demonstrated the usefulness of the phthalein tests for determining the functional capacity of the kidney in clinical nephritis. Since then many opinions have been expressed regarding the significance of this test in measuring "total renal function." The difficulty that presents itself in determining the value of this test as a measure of "total renal function" is due to the fact that not all the factors that go to make up "total renal function" are as yet known, while others are not fully understood.

CLINICAL AND FUNCTIONAL DATA. From the standpoint of clinical value of the phthalein test in cases of nephritis there are certain facts which stand out and which are generally accepted. These facts Mosenthal¹ presents in a brief and concise summary of the clinical value of the "phthalein test," as follows:

"The worth of the phthalein test has been established by too numerous observations for individual mention. The normal excretion of the drug in two hours after the intramuscular injection is 60 per cent; diminishing values to zero may be found; life is comfortable with no elimination of phthalein whatsoever, though the outlook is always serious under any circumstances—(the author has noted one case in which life was maintained for a period of two and a half years though repeated tests during that time showed that no phthalein or only traces would be present in the urine). Usually any figure of 20 per cent or less may be regarded to be of serious omen."

To the above statements may be added the following: Phthalein excretions above 20 per cent and up to 40 per cent do not invariably or, in fact, commonly, measure with graded mathematical accuracy the corresponding degree of renal impairment. As a matter of fact, there are cases of nephritis where individual readings of 30 per cent excretion of phthalein are found when the subsequent course of the case, the other functional tests and even subsequent phthalein determinations do not substantiate the original phthalein finding, and the case may actually have no symptoms of impaired renal function. Instances in which the phthalein excretion is normal with accompanying low renal function, as shown by other tests and the clinical symptoms, are also found, but they are not common.

Mosenthal goes on to say: "In certain conditions in which the kidney may be considered as being "irritated" or overactive, there is a distinct elimination of phthalein above the normal. Lewis has shown how this phenomenon occurs in early chronic diffuse nephritis, fever, hyperthyroidism and in some cases of hypertension. Such "supernormal" phthalein figures are accompanied by similar findings in the urea excretion"

¹ Endocrinology and Metabolism, vol. 4, p. 353.

"In nearly all forms of nephritis apparently the idea of Marshall and Kolls that the amount of phthalein eliminated depends upon the amount of actively functioning kidney substance seems to hold true." (Whether the individual components of the functioning whole be glomeruli or tubules, *i. e.*, "total renal function"). "There is one form of nephritis, the so-called parenchymatous, (characterized by albuminuria, diminished salt excretion and edema), in which the phthalein may be put out only in normal amounts but even in still larger quantities. Thus, Pepper and Austin report 1 such case in which as much as 82 per cent was found in two hours and Baetjer 4 cases with outputs varying from 69 to 90 per cent. These findings and those mentioned in the preceding paragraph are reminders of the fact that nephritis is a disease whose severity in some instances cannot be measured by renal function alone."

During the past year there have appeared a host of articles dealing with various forms of clinical nephritis. Many of these articles include well-planned series of functional tests illustrating degrees of renal impairment at various stages of certain forms of nephritis and paralleling the clinical symptoms.

Thus, Killian¹ reports 2 cases of *bichloride poisoning with recovery*; both cases at the height of renal impairment showed marked nitrogen retention in the blood and a well-marked acidosis. Both patients also showed a marked drop in the chloride concentration of the whole blood, this drop reaching its lowest level at the time of maximal renal impairment, as shown by the other functional tests. In 1 case the drop in plasma chloride was from 0.495 per cent to 0.114 per cent, while in the other the drop was only to 0.382 per cent; in neither case was there any edema. This phenomenon of *plasma chloride reduction* which has been noted by other observers (see Killian's article) also occurs in other forms of nephritis, more particularly after salt restriction. The well-known fact that we rarely find edema in the form of nephritis produced by bichloride of mercury is confirmed in the 2 cases reported by Killian, as neither of his cases showed this condition. The output of urine during the twenty-four-hour period was only "moderately increased," and, as has been shown by Myers and Fine² blood dilution does not account for the lowered chloride concentration.

Similar findings regarding the concentration of *blood chlorides in pneumonia* during the active stage of the disease have been made by several observers.

Funk and Weis³ report another case of nephritis produced by bichloride of mercury poisoning; this patient also recovered, these authors note the high values for retained nitrogen in the blood, the retention reaching its maximum during a period of anuria. With the gradual onset of clinical improvement and increasing urine output, normal figures for the non-protein nitrogen of the blood were found to obtain.

Concomitant with these observation, the authors have made estima-

¹ Journal of Laboratory and Clinical Medicine, December, 1922, No. 3, 7, 129.

² Journal of Biological Chemistry, 1915, 20, 391.

³ Journal of Laboratory and Clinical Medicine, January, 1922, No. 4, vol. 7.

tions of the phthalein and have also observed urea concentration test of McLean and Wesselur.¹ To quote from Funk and Weis's, "This test depends upon the decreased concentrating power of a diseased kidney and it is performed in the following manner: Fifteen grams of urea dissolved in 100 cc of water, flavored with a tincture of orange and given by mouth after the patient voids. Urine is passed at the end of one hour, and at the end of two hours both specimens being measured, and the second saved for analysis. In those cases showing an excretion of from 350 to 600 cc, or more, in the two hours, any tendency to a low concentration may be put down to excessive fluid, not to kidney disease. If the individual can concentrate urea in the second hour specimen to 2 per cent or better, his kidneys are considered efficient; if less than 2 per cent, diseased; and the lower the concentration the greater the structural damage."

The authors point out that this "urea concentration test in this case varied directly with the phthalein" and that it is a valuable functional test, although they seem to conclude this from this one case alone. They also claim that the administration of the extra urea is made without harm to the patient.

The fact that plasma chlorides and the excretion of chlorides in the urine are diminished in severe nephritis produced by tubular poisons is demonstrated by Major.² This author presents a very carefully and admirably studied case of almost pure tubular nephritis (confirmed by autopsy) produced by chronic acid poisoning. Nitrogen retention in the blood and a lowered blood bicarbonate, as observed by Killian in mercurial poisoning, is also well marked in Major's case.

Major regards the absence of any increase in the plasma chlorides in the presence of an extensive tubular nephritis as evidence in favor of the excretion of these substances by the glomeruli.

In a much more comprehensive study of the above described "urea concentration test," Rabinowitch³ reports the results of his observations with "this new" urea concentration test. The work was planned in order "to determine its value as compared with the routine methods now in use. No choice was made of the cases clinically. These were studied as they were admitted to the wards and included marked cardiac, cardio-renal and marked renal cases and those cases admitted for other clinical pictures but which were also found to have albuminuria." There are 50 cases presented. The results do not confirm the statements of Weiss and Funk as regards "a marked parallelism" between "the urea concentration test and McLean and the phthalein elimination" although in a very rough way this is borne out by Rabinowitch's work. This author also calls attention to the fact that the urea concentration test is simply a duplication of the nitrogen concentration in the urine as determined in the routine procedure of the Mosenthal test-day. The results of the urea concentration test were remarkably parallel to the nitrogen concentration in the night urine of

¹ PROGRESSIVE MEDICINE, 1921.

² Johns Hopkins Hospital Bulletin, February, 1922, No. 3721, 33, 56.

³ Archives of Internal Medicine, December, 1921, No. 6, 28, 827.

the Mosenthal test-day. How valueless both these tests may be in a given case is shown by Rabinowitch. In 1 case, that of a woman suffering from acute nephritis, with much albumin, casts, and red cells in the urine, the functional tests showed no impairment throughout the course of the patient's hospital stay while the nitrogen and urea concentration showed definite diminution; this diminution persisted even at the time she was discharged from the hospital clinically improved.

This author also presents a table showing the routine functional tests employed by him in the Montreal General Hospital for estimating kidney function.

ROUTINE ADOPTED FOR ESTIMATING KIDNEY FUNCTION.

Clinical conditions.	Examination. ¹									
	NPN	BU	BCr	UrAc	NCl	PST	RTM	NU	AUT	DIO
Hypertension	+	+	+	+	+	+	+			
Suspected early nephritis	+	+	+	+	+	+	+			
Acute nephritis	+	+	..	+	+	..	+	+	+
All edemas	+	+	..	+	+	..	+	+	
Surgical kidneys (preoperative)	+	+	+	..	+	+	
Prostatic enlargement (preoperative)	+	+	+	+	+	+	+	
Cardiac cases (for diagnosis)	+	+	+	..	+	+	+	..	+	
Cardiac cases (for progress)	+	+	+	..	+	..	+

"Judging from our experience with this routine laboratory procedure, we cannot help but conclude that there is no one single test for kidney function, which, employed to the exclusion of all others, has not its limited sphere of usefulness. It may reveal a fraction of the cause of the clinical symptoms, and a very valuable one, but at its best, it is only a laboratory aid, and must be correlated with the clinical picture in order to reach a final diagnosis, which latter has justly been called "a complex clinical judgment." The reason for this seems quite obvious. The study of a pathologic reaction is the study of a disturbed physiologic reaction, and the exact physiology of the kidney is still obscure."

Renal function, as expressed by the concentration of urea for 100 cc of blood or when taken as part of one of the various formulæ designed to express the amount of excretion, has also received the attention of several investigators—the work of Austin, Stillman, and Van Slyke as described in *PROGRESSIVE MEDICINE*, 1921, furnished the basis of some observations made by Loveland and Hitchcock.² The authors have made use of the Austin, Stillman, Van Slyke index of urea excretion to measure renal function in a group of 27 cases some with, and some

¹ Explanation of abbreviations: NPN, non-protein, nitrogen of the blood; BU, blood urea; BCr, blood creatinin; UrAc, blood uric acid; NCl, actual, calculated and threshold of blood chlorides; PST, phenolsulphonephthalein; RM, Mosenthal renal test meal; NU, night urine; AUT, urea concentration test (McLean and de Wesselow); DIO, daily intake and output of fluids.

² Johns Hopkins Hospital Bulletin, 1922, No. 378, 33, 294.

without, evidence of nephritis. Of these cases, there are 7 who were diagnosed either as nephritis or cardio-renal disease. The other cases were suffering from a variety of diseases such as pernicious anemia, serum sickness, tabes dorsalis, neurasthenia, and so forth. In addition to the urinary analysis, the following functional tests and clinical findings were studied in conjunction with the Austin, Stillman, Van Slyke index for urea excretion, the phthalein test, blood-pressure determinations, eye-ground examinations, urea nitrogen and non-protein nitrogen of the blood. The protocols published do little more than suggest that the above-mentioned index "may be of value in demonstrating renal insufficiency and particularly in border-line cases." The authors find that there are other conditions, such as hypertension with no evidence of renal disease and no impairment of other functional tests who give a strikingly low reading in terms of the index. This low reading was also found quite consistently in cases of pernicious anemia. Depressed renal function (as shown by other functional tests) has also been observed by Mosenthal, Christian and others in pernicious anemia.

This work is inconclusive in that it fails to show any striking advantage gained from applying this particular index of urea excretion as a measure of renal function, or in detecting early functional impairment when compared with other functional tests.

That the urea test of Austin, Stillman, and Van Slyke is a definite addition to our armamentarium of functional tests is indicated by the following conclusions drawn by the above-named authors in data as yet unpublished. (Austin, Stillman and Van Slyke—oral communication.)

They conclude that there is a striking parallelism between the values found by means of this test and the values found in the phthalein test in all forms of nephritis and particularly in those cases when high phthalein values are found, (so-called "irritative" stage).

This test also is apt to be found normal in certain cases when the blood urea is high, but when the clinical picture, the other functional tests and the subsequent course of the case indicate that the high blood urea is not evidence of corresponding renal impairment.

The high normal or normal figures of Hitchcock in cases with other evidence of slight renal impairment are in all probability thus explained.

It seems to me that the best method of approach to the problem of "what is the value of a given functional test as regards its value in detecting early renal disease" is to observe the course of renal disease and its effect upon a given group of functional tests in suspected cases, of nephritis at an early stage, with subsequent similar and systematic observations as the disease progresses. When this has been done in a large and carefully controlled group of cases, then and only then will we learn to appreciate the full value of any given test for renal function. Certain observers have claimed that an elevation of the blood uric acid is the earliest evidence of beginning impairment of renal function, such statements, in the light of our present knowledge, must remain as expressions of individual opinion. In the first place, the normal range of blood uric acid has never been definitely determined, and in the second

place we do not know what other clinical conditions may, or may not be characterized by transient or permanent increases in uric acid.

Ever since 1913 Addis and his coworkers have been working upon a renal functional test which, according to Addis, would best serve as "an indirect measure of the amount of secreting tissue present" in cases of chronic nephritis.

This work has dealt almost entirely with an attempt to formulate laws which would govern conditions of the rate of urea excretion under functional strain. Numerous papers have appeared from Addis's Clinic in the past nine years—some of them having been reviewed in *PROGRESSIVE MEDICINE*, 1920 and 1921.

In his article in the *California State Journal of Medicine*, March, 1922, the author has finally adopted a test for measuring the urea functional capacity of normal and pathologic kidneys—his opinions concerning its usefulness and the details of technic are given in his own words.

"The blood urea concentration is first determined in order to find how much urea will have to be given. If, as often happens even in fairly far advanced cases of Bright's disease, there is no increase in the amount of urea in the blood the patient is given 30 grams of urea, or 20, 15, 10 or 5 grams, depending on the degree of urea retention which may be present. If the urea concentration in the blood is over 75 mgs. per 100 cc, no urea need be given. At 6 A.M. next morning the patient slowly drinks a quart of water in which the required amount of urea has been dissolved, and every hour thereafter drinks two glasses of water. No breakfast may be taken, since protein food has a marked effect on the rate of urea excretion quite apart from its effect on the blood urea concentration. By 9 A.M. the apex of the curve of the raised blood urea concentration is passed and during the next three hours it falls slowly. This is the time during which three accurately-timed urine collections are made, and the level of the curve of blood urea concentration determined by analyzing three samples of blood drawn in the middle of each of the three periods over which the rate of urea excretion is measured. From these the rates of urea excretion per hour are calculated and divided by the amounts of urea found in 100 cc of the blood obtained in the middle of each period. In the same individual under these conditions this ratio remains nearly constant.

"In different normal individuals there are constant individual differences. The average ratio for normal individuals is approximately 50—*i. e.*, there is 50 times more urea excreted in one hour's urine than is found in 100 cc of blood removed while the urea is being excreted. This is independent of the actual level of blood urea concentration. We have a large number of observations of normal individuals, but we are still collecting further data, and it will be some time before it will be possible to determine the probable error of the ratio in normals. We have a series of observations on patients on whom the blood urea concentration and the phenosulphonephthalein test gave normal results, who yet gave ratios below the lower limit of normal variation. In such cases we believe that the degree of depression of the ratio measures in an approximate manner the degree of destruction of the actively

secreting renal tissue. We believe that from these functional results we are justified in drawing conclusions as to the extent of the pathologic process in the kidney."

Pericarditis in Nephritis. In an important study on the incidence and nature of pericarditis with effusion in chronic nephritis, Barach¹ shows that if all the reliable observations found in the literature are taken into consideration the incidence of pericardial effusion at some stage during the course of chronic nephritis is about 8 to 10 per cent. Among all the cases of pericarditis, nephritis ranks third as an etiologic factor.

The author has also studied the etiology of pericarditis in chronic nephritis. The clinical and laboratory characteristics of a group of 30 cases of chronic nephritis at the time of development of an acute pericarditis showed that the complication occurred in the nitrogen retention type of nephritis, with marked elevation of the blood urea, acidosis, hypertension, severe anemia, and a hemorrhagic tendency as conspicuous features. A comparison of the bacteriologic with the pathologic findings suggested a division of the cases etiologically into two groups, infectious and non-infectious. In the first group pyogenic infection of the pericardium was demonstrated by direct culture, and was accompanied by a cellular infiltration predominantly of polynuclear type. In the second group the pericardium was sterile on culture and showed histologically either mononuclear infiltration or no infiltration whatsoever. The chemical nature of the toxemia lends corroborative evidence of the existence of a chemical irritant as cause of the acute pericarditis of the second group: It appeared from the pathology that the majority of cases of pericarditis occurring in chronic nephritis were of non-infectious origin. In the smaller group in which frank infection of the pericardium is found the possibility is present that the infection may have become lodged upon a pericardium previously inflamed through a chemical or non-infectious agent.

The striking feature of Barach's work which makes it a very valuable contribution, is the completeness and extensiveness with which the cases were studied.

PATHOLOGY. Another attempt at classifying renal disease chiefly from an anatomic basis is offered by Bell and Hartzell in a somewhat lengthy paper. As far as one can gather from the text, the material presented is based upon the microscopic findings in the kidneys of 3300 consecutive autopsies. The authors do not make it clear how many of these cases were considered to have had nephritis—brief and in most instances inadequate case histories, together with clinical findings and a description of microscopic kidney morphology are presented in 69 cases of nephritis. These cases all showed more or less glomerulonephritis.

The authors announce in their opening paragraph, that "there are four well-established types of renal disease that must be considered in a discussion of nephritis." These four types with their subdivisions are as follows:

¹ American Journal of the Medical Sciences, January, 1922, No. 1, 163, 44.

I. *Pyelonephritis.*

(a) Acute interstitial nephritis seen most commonly in scarlet fever "is related to this group in that it is an exudative inflammation of the interstitial tissues."

(b) "Spontaneous chronic nephritis" of laboratory animals is claimed to be "more closely related to pyelonephritis than to any other form of human renal disease." Both these forms of nephritis seem to be types of pyelonephritis, according to Hartzell and Bell.

II. *Nephrosis.*

"This group is not sharply separable from glomerulonephritis since cases of degeneration occur in which it is very difficult to determine whether there are any reactive changes in the glomeruli."

Nephrosis, according to Bell and Hartzell, is a "term applied to renal lesions of a degenerative character in contrast to nephritis in which the phenomena of reaction (exudation, proliferative) have appeared."

The authors also make the statement that "nephrosis is by far the commonest form of renal disease seen at necropsy." They also add that they did not encounter any cases of chronic nephrosis in their necropsy material similar to the types seen by Volhard and Fahr, cases of this type having been designated by Volhard and Fahr as "genuine" nephrosis. This is probably the same type of nephrosis upon which Epstein has laid so much emphasis and which is spoken of by him as a metabolic disease. See *PROGRESSIVE MEDICINE*, 1921.

III. *Arteriosclerosis of the Kidneys.*

(a) Senile type.

(b) Hypertension type.

It is admitted that the arteriosclerotic type of renal disease is "not sharply separable from" glomerulonephritis, but Bell and Hartzell believe that there is "no justification for the view that the two diseases are indistinguishable" as Moschcowitz claims.

IV. *Glomerulonephritis.*

(a) Acute.

(b) Subacute.

(c) Chronic.

The clinical records of microscopic findings alluded to above in 69 cases are apparently all taken from this fourth group. After a careful study of the subject, clinical and microscopic data, we are unable to find that the authors make any important distinction between acute glomerulonephritis of Group IV and the acute interstitial nephritis of Group I except that, according to Bell and Hartzell, acute interstitial nephritis frequently occurs in scarlet fever and rarely in other infections, whereas acute glomerulonephritis usually occurs with other infections, such as infections with streptococci.

The belief is held by these authors that all cases of acute glomerulonephritis are most probably of infectious origin—this is also the belief of the vast majority of observers and the microscopic findings in such kidneys at autopsy would confirm this view in spite of the fact that bacteria cannot be found in the glomerular endothelium—an observation made by Ophuls and others.

The etiology of subacute glomerulonephritis is discussed in conjunction with that of chronic glomerulonephritis (according to the authors a case of the former becomes chronic when the duration of the disease has exceeded one year), the evidence deduced by Bell and Hartzell is in favor of the assumption that chronic glomerulonephritis probably owes its origin to an infection (clinically marked) and that repeated exacerbations of acute glomerulonephritis give to the chronic form of the disease its progressive nature. The authors' summary of the evidence presented and the conclusions and hypotheses derived therefrom are given verbatim:

"Thirty-two cases of acute glomerulonephritis have been studied. In many of these cases death was due to extrarenal causes and early glomerular lesions are available for study.

"Degenerative, exudative and proliferative types of inflammation occur in the glomeruli. Proliferative changes are chiefly responsible for permanent glomerular damage.

"Acute glomerulonephritis is nearly always due to some acute infectious process, usually a streptococcal infection. The bacteria gain access to the blood and it is probable that the injury is produced by the direct action of their bodies on the glomerular endothelium.

"An occasional case of acute glomerulonephritis passes into the chronic form; but the great majority of chronic cases do not begin as frankly acute nephritis.

"Acute glomerulonephritis is linked with the chronic form by numerous intermediate cases.

"Glomerular lesions in chronic kidneys correspond to healing or healed stages of acute glomerulitis. Old epithelial crescents are common, and disintegrating polymorphonuclear leukocytes are frequently found in the closed glomerular capillaries and in the partially atrophied tubules. In a few chronic cases acute and subacute glomerular lesions were found, indicating acute exacerbations.

"In chronic glomerulonephritis many glomeruli are obliterated completely and those persisting show permanent closure of a part of the capillary network. Function is carried on by damaged glomeruli, and is depressed not only because of reduction in the total number but also because of the reduced capillary network in those that persist.

"The progressive nature of chronic glomerulonephritis is apparently due, in part, to repeated acute exacerbations.

"All forms of glomerulonephritis are due directly to bacterial invasion of the glomeruli; and the various clinical and pathologic types depend on the degree and extent of the permanent glomerular injury."

The theory of the *infectious origin of nephritis* alluded to in the work of Bell and Hartzell above is further emphasized by Emerson¹ and his coworkers. This author believes "that in chronic nephritis there usually are two processes to consider: 1, The chronic, that is the permanent element, the epithelial cell proliferation and the scar tissue formation, both of which are evidences of healing. 2, An acute

¹ The Acute Element in the Chronic Nephropathies, Journal of the American Medical Association, 1921, **77**, 744.

injurious element of the nature of a definite acute nephritis which perpetuates the disease and indirectly increases the permanent lesion." Although in the above quotation there is no specific mention of acute infections, the author obviously believes that the acute exacerbation so often repeated in the course of chronic nephritis and which are usually accompanied by fever, represent the effect upon the kidney of infectious processes elsewhere in the body. Emerson has made a careful study of the course of events in many cases of chronic progressive nephritis and draws attention to the fact that there are intermittent periods lasting for several days or weeks where the patient develops slight or marked febrile reactions succeeded by periods of normal temperature. During these febrile periods many of the functional tests are diminished and the urine very frequently shows an increased amount of albumin and red blood cells. In each succeeding period with normal temperature although the albumin and red blood cells may disappear or are much diminished, the renal function tests, although they may regain their position on a higher level than during the febrile period, show a steady downward tendency if succeeding afebrile periods are contrasted one with another. Emerson concludes that these findings demonstrate the fact that no stone should be left unturned in seeking hidden foci of infection and of controlling dietary factors which may have an influence on the downward progress of the disease. Ritchey,¹ working in Emerson's clinic, presents the complete statistics upon which the foregoing conclusions are based. He reports 24 cases of acute nephritis 22 of whom showed fever, 25 cases of chronic parenchymatous nephritis 16 of these showed fever, 110 cases of chronic interstitial nephritis, 77 having had temperature at some stage of the disease. Ritchey draws the following definite conclusions: (1) During febrile elevation in the course of chronic nephritis due either to infection or to some other agent there is noticeable and measurable depression of renal function. (2) A great majority of all cases of chronic nephritis showed a temperature at some time during their course. (3) That fever with an increase of albuminuria shows an added acute process.

These studies of Emerson and Ritchey are particularly interesting because of their extensiveness and because of the new light they cast upon the picture of renal disease studied carefully over a long period of time. Febrile reactions should undoubtedly be more carefully and more frequently observed.

PHYSIOLOGY. A most important piece of work by Richards, on renal physiology, briefly alluded to in *PROGRESSIVE MEDICINE*, 1921, was presented in one of the Harvey Society lectures in 1921—and reprinted in the *American Journal of the Medical Sciences* in January, 1922.

This work is analogous in its importance to the work of Krogh on capillary circulation and is the most valuable contribution to our knowledge of renal physiology that has appeared in the past twenty years.

The author outlines in a clear and consecutive manner the history

¹ *American Journal of the Medical Sciences*, June, 1922, **163**, 882.

of the development of the so-called glomerular filtration and tubular resorption theory of normal renal physiology. He emphasized the fact that the preponderance of experimental evidence is in favor of this explanation of the mode of urinary secretion. The only evidence which would seem to contradict the above hypothesis is the work of Heidenheim who showed that, by partial or complete occlusion of the renal veins, urinary secretion could be materially lessened or wholly suppressed. This fact, according to Heidenheim and others, refuted the theory that urinary secretion (at least that part of it that was concerned with the excretion of water and salts) was explained on the basis of glomerular filtration. Richards himself admits that Heidenheim's observations constituted strong evidence against the filtration theory.

Richards draws attention to the fact that there must be three important factors all of them variable, which might influence filtration through the glomeruli. (1) Rate of blood flow through the kidney. (2) Amount of blood passing through the kidney. (3) Pressure of blood in the kidney. Previous investigators had recognized these factors but had not attempted to control any two of them with the idea in mind of studying the effect of such control upon experimental conditions designed to produce variations in the third. Richards, however, was able to devise a perfusion apparatus whereby arterial blood could be constantly passed through the renal artery under conditions which enabled him to keep the rate of blood flow and the amount of blood constant. He was then able to vary the blood-pressure in the perfused kidney by three methods: (1) Stimulation of the splanchnic nerve. (2) Injection of adrenalin. (3) Partial occlusion of the renal vein. Since all of these agencies raised pressure in the renal circulation, and since the conditions of the experiment were such that the rate of blood flow and amount of blood flow per unit of time were not materially affected, it seemed reasonable to conclude that the results observed were due to change in the renal blood-pressure. Each of the three agencies used increased urine formation in every instance.

Upon this evidence Richards believes that he is able to refute the objections raised by Heidenheim because, in Heidenheim's work, when no attempt was made to control volume and rate of blood flow the suppression of urine was probably due to the stagnation of blood in the glomeruli thereby increasing osmotic resistance which could not be overcome by increase in pressure alone. In other words, Richards has shown that the identical procedure employed by Heidenheim to raise blood-pressure within the kidneys, *i. e.*, partial venous occlusion, will not decrease the urinary output but will, on the contrary, increase urinary output provided the rate and volume of blood flow is kept at a constant level.

Richards work thus seems to remove the last valid objection to the belief that secretion by the glomeruli is explicable on the hypothesis of filtration.

The second important contribution made by Richard is the result of observations made upon the glomeruli of the frogs' kidney *in vivo*. By

a very ingenious method he was able to observe certain groups of glomeruli under the microscope and study the effect upon their physiology of various well recognized diuretic and vasoconstricting substances. The net result of these observations is that contrary to the conception of uniform rate and quantity of blood flow through all glomeruli at the same time Richards has been able to establish the fact that only a limited number of glomeruli are active or receiving blood at any given moment while the remainder are at rest and receiving relatively little blood. Any diuretic influence will greatly increase the number of "active" glomeruli in a given microscopic field while any vasoconstricting influence will greatly diminish the number of active glomeruli.

The length of time during which a given glomerulus may "intermit" or cease to be active is very variable and is not related to the rate of the heart.

Folin¹ reviews the development of our knowledge of the physiology of non-protein nitrogen of the blood in health and disease and incidentally shows what important contributions have been made to our more recent knowledge by the American school of physiologic chemists.

The non-protein nitrogen of blood filtrates after precipitation of the albuminous material by one or another of the protein precipitants, show that a considerable variation exists in the distribution of the individual non-protein constituents and in their total amounts. These variations, depending upon which of the many protein precipitants is used. This fact according to Folin would seem to indicate that there are some nitrogenous products which are partly thrown down with the coagulable protein and partly escape precipitation.

Folin says that the products obtained in blood filtrates may be classified in three groups:

"A. Nitrogenous waste products."

"B. Absorbed nitrogenous food material."

"C. Undetermined materials including some undetermined absorbed food products and in addition some products of unknown origin."

"It is important that the clinician should have certain definite knowledge regarding the amount of the various non-protein nitrogenous constituents found in normal blood. This information Folin has brought up to date after critical consideration of all the published data and the variations in chemical procedures with which these data have been compiled.

"The normal variations of the urea nitrogen lie between 8 mgm. and 15 mgm. per 100 cc of whole blood. The latter figure is really outside the normal, unless the subject is on a very high level of protein metabolism. In connection with upper normal values, it should be pointed out that these values may persist for two or three days or longer after the protein consumption has been reduced. A low normal level is, therefore, not necessarily obtained, because the blood is taken before breakfast in the morning.

¹ *Physiological Reviews*, July, 1922, No. 3, vol. 11.

"As a part of the total non-protein nitrogen of human blood the urea nitrogen varies under normal conditions between 35 and 55 per cent. The proportion falls most frequently between 40 and 50 per cent, but the variations are so large that it is not safe to assume, as is frequently done, that the urea nitrogen is just about one-half of the total non-protein nitrogen. In nephritic nitrogen retentions, the increase usually involves a greater increase of the urea than of the total nitrogen, and the per cent of the latter represented by urea may rise up to 70 per cent.

"Since the introduction of the urease methods for the estimation of urea, this determination has become the most popular in chemical laboratories. The determination is unfortunately by no means so dependable as many seem to think. The enzyme employed is exceedingly sensitive, is occasionally more or less completely inactivated, and yields values that are too low. The total non-protein nitrogen determination represents, therefore, a more valuable and more dependable process for the study of nitrogen retention than does the urea determination. Both normally and in nitrogen retentions the urea is more abundant in the plasma than in the corpuscles."

Commenting upon the use of simultaneous determinations of urea in the urine and in the blood as a means of determining the excretory efficiency of the kidneys, Folin makes the following statement.

"Opinions differ as to the values of such studies. The fundamental underlying assumption that the excretory power of the kidneys may be expressed in the form of a dependable constant is none too well established, however alluring it may appear to those who like to express metabolism processes in terms of mathematical formulas. The idea of the existence of such a constant certainly breaks down when it is extended so as to account for the rate of excretion of all waste products."

In setting forth the normal range of uric acid in human blood, Folin avoids making a definite statement. His summary is as follows:

"In the normal human blood the uric acid content is subject to relatively greater variations than that of any other known nitrogenous product. The lowest figure reported by Folin and Denis is 0.7 mgm., and the lowest found by Benedict out of 50 analyses is 0.8 mgm. The maximum normal figure for the uric acid may perhaps be given as 3 mgm. per 100 cc."

Creatinin content of normal blood is given as 1.2 to 1.5 mgm. per 100 cc of blood while creatin values normally range from 3.5 to 5 mgm. per 100 cc of blood, although by very recent work Behr and Benedict¹ claim that there is less than 0.05 mgm. of creatinin in normal and that only creatine is present. Folin predicts that this finding "will not long remain without contradiction or verification."

The amount of amino-acid nitrogen found in normal human blood, according to Folin, ranges from 5.7 to 7.8 mg. of nitrogen per 100 cc of blood.

Increases in amino-nitrogen content of blood corresponding to increases of non-protein nitrogen, as seen in nephritis, for the most part do not occur and are very variable when they are found.

¹ Journal of Biological Chemistry, 1922, 52, 11.

The question of the *influence of arterial hypertension in producing nephritis* has given rise to much controversy. The prevailing view at present is that patients suffering from arterial hypertension may without any clinical or functional evidence of nephritis in many instances become definite cases of nephritis. Many other cases develop cardiac vascular disease with subsequent cardiac insufficiency as the predominating clinical picture. Still another group of patients with arterial hypertension develop evidence of extensive changes in their cerebral arteries. Clinically, many physicians advocate the use of increased water drinking in patients where high blood-pressure is the only presenting symptom; that this procedure may have some value in offsetting the progressive character of arterial hypertension is suggested by the work of Orr and Innes¹ who have investigated the influence on protein metabolism of a sudden increase of the amount of water passing through the system suggest that the increased ingestion of water affects the metabolism of protein in such a way that the formation of pressor substances is reduced. Experiments were carried out to determine what influence an increased water intake has upon the blood-pressure. During a preliminary control period of two or three days the normal amount of water was taken and many systolic and diastolic readings were taken. Then for one or more days a measured amount of water was taken at one time or at intervals. On the following days the usual amount of water was taken. Thus the experiments were divided into three periods, prewater, water and postwater. Muscular exercise and emotional disturbances were elimination as far as possible. The readings were taken after the subject had been allowed to lie on a bed for fifteen minutes, with the Riva-Rocci instrument. The experiments were conducted on healthy subjects with normal blood-pressure, on subjects with blood-pressure above normal but no kidney lesions and 14 pathologic cases with markedly raised pressure. The results showed a decrease in blood-pressure in the apparently normal subjects and in the pathologic cases after ingestion of water. In the pathologic subjects there was a tendency for the pulse to rise on the water days. In all the subjects the pulse rate was slower after the ingestion of water. The fall in pressure may be due to the elimination of pressure substances that cause arterial constriction. These results are in agreement with Hay's original observations.

It is suggested that three factors may be involved in the reduction of blood-pressure noted in these experiments. The initial flushing-out process, as evidenced by the increased excretion of nitrogen, may remove pressor substances from the system. Fowler and Hawk's results suggest that anaërobic disintegration of nitrogenous material in the large intestines may be diminished, with a consequent reduction in the formation and absorption of pressor substances. Substances producing arterial contractions arise in sluggish or perverted metabolism or under conditions of protein surfeit. The acceleration of the metabolism of protein with the more rapid formation of innocuous final products would lead to the elimination of these pressor substances.

¹ British Journal of Experimental Pathology, April, 1922, p. 3961.

Treatment of Nephritis. The great number and variety of therapeutic procedures which are advocated every year in the literature of nephritis serve to illustrate how futile and unsatisfactory the treatment of nephritis is in the vast majority of cases. There are certain commonly accepted procedures, such as salt restriction, fluid restriction, protein restriction and the administration of certain diuretic substances which are universally accepted and tried in most cases.

I am therefore not going to attempt to review all the various therapeutic suggestions of the past year, most of which are unimportant, but will devote this space to the interesting observations of Blum¹ and his coworkers on the effect of certain calcium and potassium salts in relieving edema, whether this edema be due to liver, kidney or cardiac disease. The work of these authors has important bearing not only upon the problem of the relief of general anasarca but also contributes greatly to our knowledge of the fundamental physico-chemical conditions underlying the production and relief of edema from any cause.

Blum first became interested in this problem in 1910 in connection with the edema so commonly observed in diabetes after the administration of large doses of sodium bicarbonate. He found that this type of edema and also other types could be relieved by large doses of certain salts of potassium—these salts seemed to greatly facilitate the excretion of the sodium ion which was accompanied by a marked increase of water excretion and loss of body weight. These results obtain for other salts of potassium and also for certain salts of calcium. Blum has found that calcium chloride is the salt of choice for all forms of edema—potassium being contraindicated in cases of edema due to cardiac disease, while calcium is without injurious effect upon this particular condition. The dose of calcium chloride recommended is 25 gms. per day and may be given with small amounts of sodium chloride or with a “salt-free diet.”

The protocols given illustrating the water and weight loss in patients suffering from many different forms of edema—(nephritic, cardiac and hepatic)—are very convincing of the striking action of calcium and potassium salts in abolishing edema.

What makes the effect of these salts all the more spectacular is the fact that in most of the protocols submitted other diuretic procedures had yielded no result in diminishing edema in spite of the fact that they were carried out over long periods of time.

¹ Extrait de La Presse Médicale (No. 70 du 29 Septembre, 1920) M. Leon Blum. Extrait de Bulletins et Mémoires de la Société médicale des Hôpitaux de Paris (Séance du 29 Juillet, 1921) Mm. L. Blum, E. Aubel et R. Hausknecht. Extrait des Bulletins et Mémoires de la Société médicale des Hôpitaux de Paris (Séance du Novembre 18, 1921), MM. Leon Blum, E. Aubel, et Robert Levy. Extrait de Bulletins et Mémoires de la Société Médicale des Hôpitaux de Paris (Séance du 25 Novembre, 1921), par Mm. Leon Blum, E. Aubel et R. Hausknecht.

GENITO-URINARY DISEASES.

By CHARLES W. BONNEY, M.D.

DISEASES OF THE KIDNEYS AND URETER.

SOME generalizations concerning renal surgery, with special reference to the **mortality rate and postoperative results**, have been presented by John R. Caulk¹ in an analysis of 263 cases which came under his care. This is a paper which may be read with profit by all general practitioners, for the author clearly points out the significance of symptoms in the early stages of surgical renal disease and shows how their early recognition, followed by appropriate treatment, will redound to the benefit of the patient. He states that in his series there were some operative cases in which symptoms had been present for four and one-half years before the nature of the trouble had been recognized. An early diagnosis in some of these cases would have obviated the necessity for surgery.

One of the most important statements which the author makes, is to the effect that if cystitis does not clear up after ten days of local treatment, there is probably some associated condition which warrants further investigation. Relief of retention within the pelvis of the kidney by drainage through the ureteral catheter, lavage of the pelvis in pyelitis, dilatation of ureteral stricture, and the removal of impacted calculi by manipulation through the operating cystoscope are some of the measures that were applicable in his case. Torsion of the ureter has been cured by passage of the ureteral catheter a few times.

With regard to MOVABLE KIDNEY, the opinion is expressed that a proper fixation will practically always effect a cure. This statement, it is assumed, refers only to those cases in which the misplacement is producing symptoms directly referable to the urinary tract, and not to those in which the misplaced kidney is associated with visceroptosis. In fact, the author considers fixation of movable kidney, which is producing urinary retention, the most important technical operation in renal surgery.

In the author's series of cases, operations were performed for stone by nephrectomy, nephrotomy, pyelotomy, and combined pyelotomy, and nephrotomy; for tuberculosis of the kidney; tumor; movable kidneys with intermittent hydronephrosis, large hydronephroses, hydronephritis and perinephritic abscess and, finally, for nephritis, in which decapsulation was done. There were 5 deaths in 263 operations. When discussing the indications and preparatory treatment, the author states that the heart, lungs and nervous system must be put in the best condition pos-

¹ Journal of the American Medical Association, September 10, 1921.

sible and that, except in emergency, no operation should ever be done without adequate preparation. In the presence of infections, preparatory drainage should be used. If there are renal calculi, infected hydro-nephrosis or pyelonephritis, continuous drainage with the ureteral catheter will bring about improvement. The patients should drink large quantities of water, and urinary antiseptics, such as urotropin and acid sodium phosphate, should be given. In septic cases, as well as those in which the hemoglobin is low, transfusion may be resorted to with benefit. The Murphy drip may be advantageously used before operation as well as after. A mixture of gas and oxygen is considered the best anesthetic, though sometimes it will have to be supplemented by a little ether. After operations for stones, the author always instills the pelvis with silver nitrate solution in order to overcome infections and stimulate granulations. This is done during convalescence by means of an injection through the ureteral catheter.

In a report upon the material from Martynoff's clinic in Moscow, the *accidents occurring in association with nephrectomy* are discussed by Fronstein.¹ One of the most frequent injuries was opening of the peritoneum. When immediately sutured, usually no complications followed, although in 2 cases of secondary nephrectomy for renal fistula a fatal peritonitis resulted from the accident. When breaking up adhesions between the colon and kidney in chronic inflammatory conditions, there is some danger of producing a fecal fistula, and in some such cases the author considers it better to perform a resection of the bowel than to traumatize it by a prolonged effort to free it from the kidney. In 1 case of renal tumor involving the cecum, Martynoff removed the kidney, resected the cecum and then made a transverse anastomosis between the ileum and the colon. In 1 case gangrene of the bowel followed nephrectomy. It was, however, attributed solely to the haste and roughness of the assistant, who made very hard pressure upon the abdominal wall in order to facilitate delivery of the kidney through the lumbar incision. Hemorrhage from the bowel was not noted in any of Martynoff's cases, although in a series of 206 kidney operations in Fedoroff's clinic in St. Petersburg the author states he is informed that it occurred 4 times. This complication is attributed to thrombosis of the mesenteric veins. Injuries to the pleura are not uncommon and are frequently followed by pneumothorax and empyema unless the tear is immediately repaired. When immediate closure is made, there are usually no bad effects. Hemorrhage is considered the most dangerous complication. It may result from injury to normal or supernumerary renal vessels and also from injury to the vena cava and the iliac artery. In Martynoff's clinic, mass ligation of the renal pedicle is never practised, the component parts being carefully separated and the arteries, veins and ureter individually ligated. It is not considered safe to leave a clamp on the pedicle. In a search through the literature, Fronstein found a record of 25 cases in which the vena cava was torn; in 12, the patients recovered; in 13, they died. As a rare complication, reflux

¹ Nautschnaja med., 1921, 1, No. 8.

of the urine from the bladder into the remaining portion of the ureter is mentioned. A more common sequel was suppuration in the ureteral stump, especially in cases of pyonephrosis. One such case is mentioned in which 3 operations were necessary to effect a cure. In last year's review the methods of dealing with the ureter in renal tuberculosis were fully discussed. In this connection it is interesting to note that Martynoff does not favor an extensive removal of the ureter, his rule being to remove as much as can be easily liberated through the usual lumbar incision. He crushes, doubly ligates with catgut and then divides with the thermocautery. One death from anuria followed nephrectomy in a case in which the other kidney responded well to a number of functional tests. Anuria developed in another patient whose kidney had been removed under morphine-ether anesthesia. Thirty-nine hours after its onset, renal decapsulation was performed, but death occurred sixteen hours later. Autopsy revealed an acute parenchymatous nephritis.

In the Hunterian Lecture delivered at the Royal College of Surgeons this year, hydronephrosis was fully discussed by Charles A. Pannett,¹ who, at the beginning of his lecture, stated that his object was to arrive at a truer conception of the genesis of upper urinary retentions, to review modern methods of recognizing them in their early stages, and to describe the various forms of treatment.

The usual causes of retention within the pelvis of the kidney include narrowing at the ureteral pelvic junction, displacement of the kidney causing kinking of the ureter, calculus impacted in the ureteropelvic junction, stricture produced by the healing of an ulcer which such an impacted calculus may cause, and, finally, periureteritis.

In addition to these commonly recognized causes, the author attributes considerable etiologic importance to spasm at the ureteropelvic junction. A consideration of the salient facts of renal secretion and discharge has led him to the conclusion that the renal pelvis and the ureter possess decidedly different functional attributes. It is well known that the passage of the urine down the renal tubules into the pelvis of the kidney is continuous, and also that the discharge of urine from the ureter into the bladder is intermittent. In view of these phenomena the theory is advanced that the renal valves act as a temporary reservoir for the urine, being separated from the ureter by muscular contraction at the ureteropelvic junction. At certain intervals the pelvis contracts and with this contraction there is a relaxation at the ureteropelvic junction, as the result of which urine passes into the ureter and is carried onward by peristalsis. A number of experiments are cited to substantiate this theory; and, furthermore, cases of hydronephrosis are cited in which, at operation, a fair sized catheter could be passed downward through the ureter without meeting any obstruction, the pelvis of the kidney alone being distended. Whether such spasm is due to irritation of the kidney or pelvic wall, as, for instance, by some change in the composition of the urine, or to extrinsic nervous reflex, the author is unable to decide.

¹ British Journal of Surgery, April, 1922.

Pannet believes that the frequency of congenital valves at the upper ureteric aperture has been overestimated and that they are probably a very rare cause of hydronephrosis. He points out, however, that a congenital valve must not be confused with a secondary valve which forms as the result of the hydronephrosis itself. He is also inclined to attribute very little etiologic importance to abnormal polar vessels.

With regard to the latter opinion space may be taken to note that R. H. Kummer¹ has collected more than 50 cases in which hydronephrosis was apparently due to the presence of an obstructing abnormal renal vessel. He also reports 3 from Marrion's clinic in Paris.

In the reviewer's mind no doubt exists as to the positive etiologic role of abnormal renal arteries situated at the lower pole.

Clinically, unless the condition is so far advanced that a renal tumor is formed, there will be no symptoms sufficiently characteristic to enable a surgeon to do more than suspect the presence of beginning dilatation of the renal pelvis. The pain is such in character and location that it may lead one to believe that the trouble is situated outside the urinary system. The urinary findings are also very inconstant, and may even be absent in a considerable number of cases. Cystoscopy, with ureteral catheterization and pyelography, will make the diagnosis clear. The changes brought about by distention are minutely described, and the methods of technic and interpretation of the pyelograms are also fully explained.

In the choice of treatment lying between nephrectomy and some measure by which the kidney may be conserved, it is essential to determine two things: (1) The existence of another healthy kidney, and (2) the functional power of the diseased kidney. The first is established by cystoscopy. Accompanying every hydronephrosis there is always some chronic interstitial nephritis and failure of renal function. Naturally, the functional renal tests will be of some value in obtaining an answer to the second question, but the author expresses the opinion that neither the determination of the urea debit nor the elimination of phenolsulphonephthalein furnish absolute indications for a radical or a conservative operation. He cites the experience derived from treating cases of prostatic hypertrophy by preliminary drainage of the bladder, explaining how the functional power of the kidneys will frequently show marked improvement after back pressure has been relieved by vesical drainage. In hydronephrosis visual estimation of the amount of renal tissue remaining, as determined at operation, will afford a more accurate guide than preliminary functional tests. Braasch is quoted to the effect that when the hydronephrosis contains more than 150 cc, very little secretory tissue remains.

During a period of three years 15 cases came under the author's observation. Out of this number nephrectomy was necessary in 4—on account of extensive distention and destruction of kidney substance. Another nephrectomy was done to remove an obstructing tumor. Nephropexy was performed three times, pyelotomy for stone twice,

¹ Journal d'Urologie, June, 1922.

pyeloplication once and ureteropyeloplasty three times. One patient was not operated upon.

The decision to perform a plastic operation having been reached, the question arises whether by removing the hindrance at the upper end of the ureter, conditions will be rendered such that the dilated pelvis will shrink and recover its normal function. In view of well-known physiologic facts, the author believes that such will not prove to be the case unless the pelvis is emptied at operation and kept empty by drainage for a considerable time. If the pelvis be made smaller by resection, return to normal may perhaps be facilitated. However, it is considered better to employ drainage as a matter of routine.

The following opinions concerning the different surgical procedures are expressed: Nephropexy is considered the proper surgical treatment for cases of physiologic obstruction accompanied by abnormal mobility. A small tube should be used for draining the renal pelvis. It emerges from the wound made for the passage of bougies down the ureter. Nephropexy should also be performed when any plastic operation has been done on the renal pelvis.

Ureteropyeloplasty is thought to be the best operation when there is a congenital stricture and the wall of the ureter is not inflamed or fibrosed. Pelvic drainage must be provided by special incision. This plastic operation may be advantageously combined with resection of the lower part of the pelvis. Should the insertion of the ureter be very high, reimplantation of the ureter, or lateral anastomosis, is necessary. When the upper part of the ureter is obliterated by disease, drainage is necessary. Lateral anastomosis of the ureter to the lowest part of the pelvis is considered preferable, for it preserves muscular continuity between the pelvis and ureter, whereby the coordination of pelvic contraction with ureteric peristalsis is uninterrupted.

Pyeloplication and pelvic resection are indicated when the ureteric orifice is of good size, but situated high; and division of a secondary valve is also very satisfactory.

Reviewing the results of these different plastic operations, it may be stated that there is a very fair prospect of preserving the function of hydronephrotic kidneys by their aid. When it is remembered that many excellent results were obtained at a time when diagnosis could only be made by the palpation of a tumor and the condition was necessarily advanced, it will be understood that with our modern methods of diagnosis the outlook for the future is much brighter.

The Indications and Technic for Nephroureterectomy form the subject of an interesting paper on renal surgery from the pen of Edwin Beer,¹ Mt. Sinai Hospital, New York. The operation is recommended for the following conditions; namely, tumors, special papillary growths, tuberculous kidney with stricture of the lower ureter, and impacted stone in the lower portion of the ureter associated with extensive hydronephrosis and hydroureter.

The operation is performed as follows: The kidney and pelvis are

¹ Journal of the American Medical Association, October 8, 1921.

freed from the vascular pedicle, which is ligated, and the ureter is then separated by blunt dissection as far as the fingers can reach, usually to about the level at which the iliac vessels cross it. Then it is ligated and the suture is left uncut so that it may be used for traction later in the operation. Through a second incision at the outer border of the rectus muscle, the ureter can be identified by intermittent traction made upon the suture. It is gradually freed, the dissection being carried down to the bladder, and finally is doubly ligated and divided with the cautery-point or a knife dipped in carbolic acid. The last stage of removal consists in bringing the kidney and ureter out through the lumbar incision. The author believes that this method considerably lessens the danger of opening the ureter or wounding the peritoneum, and that it does not constitute an increased operative risk.

During the last few years **decapsulation for nephritis** has been discussed in this review on two occasions. A case sufficiently interesting to warrant brief description here was recently reported by Norris W. Vaux.¹ It was that of a boy, aged six years, suffering from chronic nephritis. After all of the usual methods of treatment had been tried without benefit, decapsulation of the right kidney was performed under nitrous oxide and oxygen anesthesia. At the time of the operation the child's condition seemed hopeless. Prompt improvement took place after the operation and it was decided to decapsulate the left kidney. Within a few weeks after the second operation the child was playing about the ward and showed no signs of having been sick.

Renal Calculus. J. D. Barney² has studied 139 cases of renal calculus, which were treated at the Massachusetts General Hospital, and has given special attention to the subject of recurring or overlooked calculi. The number of patients in whom subsequent examination showed the presence of one or more stones is surprisingly large. For example, 50 per cent of those upon whom pyelotomy had been performed, subsequently were found to have calculi remaining in some part of the kidney. Of 20 patients who were examined with the roentgen rays during convalescence, 9 showed stones. Seventy patients were treated by nephrotomy and more than one-half of them (52.9 per cent) were found to have stones which either had been overlooked at the time of operation or had reformed after operation. Barney's own experience with renal calculus and his study of the experience of others at the institution at which he is working, have convinced him that it is not always possible to remove all stones from the kidney. He expresses the opinion, however, that the percentage of failures will be reduced in direct proportion to the care that is taken before and during operation. Preoperative study and localization of the stone-shadows are considered absolutely necessary; and, if possible, a roentgen-ray examination should be made on the day of the operation. The use of the fluoroscope during the operation may also be of help.

Pyelotomy is considered adequate for the removal of small stones even when a number are present. Nephrotomy is advised only when

¹ New York Medical Journal, November 2, 1921.

² Boston Medical and Surgical Journal, January 5, 1922.

the stone is of such size and shape as to make its extraction through the renal pelvis impossible. In the author's own cases nephrectomy was performed when the kidney was badly infected and contained a very large stone or many small ones. The mortality in operations performed for multiple stone was 3.5 per cent. Two of the deaths were due to pneumonia, 1 to uremia, 1 to hemorrhage after nephrectomy and 1 was attributed to the anesthetic.

Gonococcal Infection of the Kidney. An interesting case of gonococcal infection of the kidney has been reported by R. R. Simmons.¹ It was that of a man who had had gonorrhea for four or five months and who received a very hard blow on the abdomen which necessitated an exploratory laparotomy. No signs of injury could be found within the peritoneal cavity, but there was a mass in the region of the right kidney. The patient was turned over and the kidney exposed through a lumbar incision. The renal substance had undergone considerable destruction as the result of hydronephrosis and through its thinned cortex beneath the unbroken capsule a break in continuity could easily be felt. Thus, it was seen that the attenuated renal tissue had been fractured by the force applied to the abdominal wall. The kidney pelvis was explored for stones, but none were found. Smears were made from the pelvis and its contents, and a large number of intracellular and extracellular Gram-negative diplococci were found. They were cultured and a pure growth of gonococci obtained. Simmons was unable to determine exactly how long the gonorrheal infection had been present in the kidney, as the patient was unable to recall any symptoms that would point to its onset. Inasmuch as no vesical symptoms had been experienced, it seems probable that the renal infection was of hematogenous origin. This case led the author to make an investigation of gonorrheal infection of the kidney, as the result of which he was able to find only 24 authentic cases recorded in the literature. Including the 1 which he reports, only 15 were proved to be pure gonorrhea. In others, a mixed infection was present. The organism most frequently found in association with the gonococcus was the colon bacillus. Sixteen of the cases were in men. The earliest symptoms referable to the kidney occurred ten days after the onset of acute urethritis and the latest case occurred nine years after infection. There was an associated bacteriemia in 3 cases. In 6 cases both kidneys were affected.

Lavage of the Renal Pelvis. To show the comparative effects of the various solutions used for pelvic lavage, O'Connor² performed experiments upon 30 dogs. In some cases the injections were given by gravity; in others the syringe was used. It was found that when a non-irritating solution was injected, no physical changes in the epithelium of the pelvis or ureter were brought about by slight overdistention continued for thirty minutes. With regard to the penetrating action of various drugs, it was found that boric acid, acriflavine, brilliant green, gentian violet, aluminum acetate and silver nitrate had very

¹ Journal of Urology, February, 1922.

² Journal of the American Medical Association, October 1, 1921.

little effect below the epithelial lining. The penetrating power of mercurochrome was greater than that of the other substances used, as it worked its way through the superficial layers and came into contact with the tubular epithelium and the parenchyma tips of the pyramids. The submucosa and muscularis of the ureter and renal pelvis retained the dye from five to seven days without any reaction in the surrounding tissue being produced. Within twenty minutes after injection, the dye had travelled directly up the lumen of the individual tubule as far as the glomerulus, but there was no dye in the opposite kidney.

Flavine and brilliant green stain the superficial layer and the ureteral and pelvic epithelium a uniform yellowish green, and gentian violet also stains them faintly; but no evidence of any of these dyes was found in the deeper structures or renal tubules and there was no round-cell infiltration near the dye. Following the injection of aluminum acetate solution, retained for thirty minutes, the epithelial lining was found intact, although the regularity of the cell strata was affected. Silver nitrate produced a marked superficial reaction, but no evidence of penetration could be found below the epithelial lining. Six days after its injection disintegration of the epithelial cells ceased and evidences of regeneration were observed. In ten days the epithelial lining was completely restored and the superficial layers of the cells were intact.

The author suggests that the alternating use of mercurochrome, or some equally penetrating dye, and silver nitrate may give better therapeutic results than will be obtained by the continual use of only one of these substances.

Functional Renal Diagnosis. A symposium upon this subject was recently held at a combined meeting of the Berlin Urological Society and the Society of Internal Medicine,¹ in which both the surgical and medical aspects of the subject were discussed. Casper stated that urologists should take into consideration not merely surgical diseases of the kidney, but that they should also be familiar with the TESTS APPLIED IN MEDICAL RENAL CASES. The injection of coloring matter, iodide of potassium, milk sugar and other substances, with dilution and concentration tests; the estimation of urea in the blood; the excretion of salt, and the determination of Ambard's index will enable one to get an idea of the different separate activities of the kidney and to formulate appropriate methods of treatment. While the internist has to deal with disease in both kidneys, the surgeon's activities are usually confined to only one kidney. The latter's problem therefore is to determine the functional capacity of each kidney separately and to form an opinion if one is capable of carrying on the work of the organism after the other has been removed. With reference to the latter subject, frequent tests are advised, and in the author's practice the following ones are made. After testing the urine obtained from each kidney separately by means of the ureteral catheter, one of the color tests is

¹ Zeitschrift für Urologie, 1921, Heft 8.

performed; this is followed by a phloridzin test; and, finally, comparison is made between the blood nitrogen and the nitrogen in the urine of each kidney. He also employs the concentration and dilution tests.

The former consists in determining the concentration of the urine when the least possible amount of fluid is drunk. In healthy persons it has been found that the specific gravity in such cases is 1.025 to 1.035, but in kidney insufficiency the specific gravity remains about constant, the water being drawn from the kidneys and the individual losing weight. In this test errors of calculation may arise from the amount of water stored up in the tissues at the beginning of the test so that the concentration may not increase. In edema, therefore, the test is not applicable. Such an error may perhaps be overcome by a preliminary determination of the concentration at a time when the patient is taking a moderate amount of fluid.

In the dilution test the patient drinks $1\frac{1}{2}$ liters of water or weak tea. The rapidity of the dilution is determined by taking the specific gravity of the urine voided. Extrarenal factors, such as cardiac weakness and edema, also influence the result in this test. Richter, who took part in the symposium, attributes considerable value to these tests when both give a positive result.

Casper still thinks highly of the phloridzin test. That the excretion of sugar takes place in the kidney is shown by an experiment that he has recently performed: namely, the injection of the drug into the renal arteries. For example, if it be injected into the right renal artery it appears in the urine from the right kidney. This test he considers superior to any of the color tests and also better than the potassium-iodide test. When 0.01 of phloridzin is injected subcutaneously or intramuscularly, the healthy kidney secretes glucose in fifteen to twenty minutes after injection and ceases to secrete it in two or three hours. So regularly have these phenomena taken place in thousands of cases that the author states the absence of sugar secretion distinctly shows the kidneys are not performing their function. It is in such surgical conditions as pyonephroses, large hydronephrosis and tumors, in which there is extensive destruction of renal tissue, that this test is the most valuable. Acute diffuse glomerular nephritis does not prevent the phloridzin reaction except in the very advanced stages in which atrophy has taken place.

Attention is called to the possibility that occasionally an operable case may be pronounced inoperable owing to the results of functional tests, but it is certain that many more cases which are inoperable are saved from an operation which would prove fatal. The mortality of nephrectomy at present is stated to be from 2 to 4 per cent, and much of the credit for its reduction is attributed to the employment of the functional tests. Casper states that the average mortality before these tests were made as a matter of routine was more than 26 per cent. Doubtless other factors besides the functional tests have contributed to its reduction, but the latter has certainly brought about a considerable lowering in the rate.

Tardo¹ contributes an article on phenolsulphonephthalein, his object being to compare the results obtained with those given by other methods, particularly the secretion of urea and the ureosecretory constant.

The first thing that impressed itself upon the author was the almost mathematical correspondence between the urea output and the phthalein secretion. In some cases, however, in which the urea debit was satisfactory, the phthalein excretion was low. In order to investigate this discrepancy the phthalein test was made in conjunction with the determination of Ambard's constant. In every case of this kind an azotemia was found together with a high constant; so it seems that the phthalein debit showed the true functional condition of the kidneys, whereas the calculation of the urea alone was misleading.

In cases in which the urea function was markedly diminished, the phthalein debit corresponded generally to the ureosecretory constant. In cases in which the urea function was not diminished and the kidneys were normal, the outcome of the three, namely, urine debit, phthalein debit and Ambard's index, were in accord.

In a recent contribution, Aiello² discusses the importance of the *residual nitrogen of the blood in renal functions*. The term is applied to nonproteid nitrogenous substances of light weight, of which there are always small quantities circulating in the blood. Under normal conditions its components are urea, which may be said to vary from 52 to 75 per cent; creatin, 6.15 per cent; uric acid, 3 per cent; amino-acids, 8 per cent; ammonia, 0.4 per cent. The author believes that for an exact determination of the renal function, an examination of the blood for residual nitrogen gives a much more accurate result than the examination for urea. The technic is described in detail, but as the performance of the test comes solely within the domain of the physiologic chemist it will not be discussed here.

Lawrence T. Price³ also speaks favorably of this test, and likewise attributes great value to the creatin determination, a method which was described in this review several years ago. He states that retention of more than 2.5 mg. per 100 cc of blood shows that recovery will not take place.

Perirenal Inflation. A new diagnostic method which has aroused considerable interest is that introduced last year by Carrelli and Sordelli,⁴ of Buenos Aires, and which consists in injecting oxygen or carbon dioxide into the perirenal fat. The method has recently been demonstrated in this country and in Europe by its author, and a number of reports concerning it are to be found in the literature of the last few months.⁵ From the information at present available, it would seem that the essential points in the technic may be summarized as follows: Accurate localization of the transverse process of the second lumbar

¹ Journal d'Urologie.

² Il Policlinico, October 3, 1921.

³ Virginia Medical Monthly, 1921.

⁴ Rev. Anal. Medic. Argent., 1921, No. 200.

⁵ Rost: British Medical Journal, December 10, 1921; Hernaman Johnson: British Medical Journal, January 21, 1922; Delhern and Laguerrier: La Presse Médicale, February 15, 1922; Delhern and Morel-Kahn: Paris Chirurgical, April, 1922; Chevassu and Maingot: Journal d'Urologie, February, 1922.

vertebra; the use of a fine needle, which should be open while it is being passed through the tissues; the proper direction of the needle after it has struck the transverse process; determination of entrance of the needle-point into the perirenal fat by manometer readings; and, finally, slow injection of gas. Not more than 500 cm. should be injected. As carbon dioxide is more readily absorbed than oxygen, it may be considered the substance of choice. The method is to be employed in those cases of renal disease in which ordinary roentgenographic examination proves unsatisfactory. It is stated that the kidney can be seen much more plainly than when the ordinary roentgen-ray method is used and that the suprarenal body can also be brought into view.

Hernaman Johnson describes a demonstration which he witnessed as follows: The site of the second transverse process having been ascertained, a fine platinum needle about 10 cm. long was pushed in vertically until brought to a stop against the bone. Having called our attention to the fact that the needle was actually against the process, Carrelli proceeded to alter the direction of the thrust, carrying the point of the needle slightly forward and a little outward, so that it slipped past the obstruction. He pushed the needle in until he believed he had reached the perinephric areolar tissue. He then waited a moment to see if any blood came out through the needle. Had this occurred, it would have meant that a vessel was punctured, and reinsertion would have been necessary. Having satisfied himself as to this, he next connected the needle with the manometer of the oxygen container. As soon as the connection was made one saw the column of fluid in one of the bottles move up with inspiration, down with expiration. Then the manometer connection was closed and the stop-cock connecting the needle with the oxygen chamber was opened. The injection was made very slowly. The patient complained of an increasing ache in the loin and asked for the injection to cease after it had reached about 500 cm. Carrelli's usual procedure is to turn the patient on his back and take plates from above. In this demonstration, however, he used the fluoroscope while the patient was lying face downward, and the kidney was plainly seen standing out like a little island in a lake of air, according to Johnson's phraseology. The apparatus is simple, being similar to the one used for producing artificial pneumothorax and pneumoperitoneum.

Chevassu and Maingot are not especially impressed with this method, as they have found it technically difficult and have also had some accidents, among which may be mentioned a mediastinal and cervical emphysema which gave rise to alarming symptoms. The needle has also been carried through into the peritoneal cavity, even by Carrelli himself, and the authors state that insufflation of the psoas muscle is not uncommon. In some cases pockets of gas seem to be formed around the kidney, giving an irregular outline to the organ which might mislead one into making an erroneous diagnosis. On the other hand, Delhern and Morel-Kahn state they have employed the method in 50 cases without having any accidents whatever.

It would seem that a similar method, though differing slightly in

technic, has been employed by P. Rosenstein¹ and other German surgeons. In a recent contribution H. Boeminghaus² states that he has used it in 38 cases and that he considers it valuable. That it is free from danger however, he is not willing to admit, for in 1 case a patient developed signs of embolism after its employment.

Fistula Following Ureterotomy. At the April meeting of of the New York Surgical Association, Lewisohn³ showed a woman, aged thirty-two years, upon whom he had operated for ureteral stone five months before. She had had typical attacks of colic for a year prior to her admission to the hospital. They were very severe and occurred every few weeks. Roentgen-ray examination showed a very small calculus at the vesico-ureteral junction.

At operation, the left ureter was exposed $2\frac{1}{2}$ inches above its entrance into the bladder. Attempts to push the stone downward were unsuccessful. The ureter was incised and a further attempt made to dislodge the stone with instruments. These manipulations failing, it was then decided to cut down upon the stone itself. Further liberation of the ureter was effected and another incision made over the stone, which was finally removed with the aid of a sharp spoon curette. Both ureteral incisions were closed with catgut.

The incision at the uretero-vesical junction healed without delay. The incision first made into the ureter, however, did not heal, with the result that a complete urinary fistula was established. Cystoscopic and ureteral catheterization showed what appeared to be a complete obstruction on the left side about $2\frac{1}{2}$ inches above the orifice. Even very fine bougies could not pass the obstruction.

The patient was much annoyed by the profuse flow of urine through the fistula, which made very frequent changings of dressings necessary. Nephrectomy was advised, as spontaneous cure appeared to be out of the question after so long an interval, and also in view of the cystoscopic findings. However, to the surprise of all who followed the case, the fistula closed spontaneously two and a half months after the operation. No untoward symptoms followed closure and the patient has been in perfect health during the last year. A recent cystoscopy showed a well-functioning kidney, and also a slight stricture at the site of the previous urinary fistula.

DISEASES OF THE BLADDER.

Malignant Tumors. At the present time the consensus of opinion favors treatment of benign vesical growths by the high frequency spark applied through the cystoscope in all cases in which the location and size of the tumor make it possible to reach and destroy it by this method. The original work of Beer, of New York, received notice in this review a number of years ago and since that time the experience of numerous urologists has been recorded. For the

¹ Zeitschrift für Urologie, 1921, Bd. 15, Heft, 11.

² Zeitschrift für urologische Chirurgie, 1922, Bd. 9, Heft 2.

³ Annals of Surgery, August, 1922.

destruction of benign papillomas the method leaves nothing to be desired. As experience has accumulated, it has been found that endovesical fulguration is not applicable to papillomatous growths which present induration or circulatory changes around the base, even though they appear to be benign. In such cases it is better to open the bladder and treat the neoplasm more thoroughly at one time than can be done through the scope.

The application of Beer's method to malignant vesical tumors has also received some attention and the experience of Young and others in this class of cases has been narrated in previous issues of *PROGRESSIVE MEDICINE*. During the year, two interesting papers upon the subject have come to my attention. One is by Kolischer and Katz,¹ of Chicago, and the other by Corbus,² of Chicago.

Kolischer and Katz have treated 27 cases of malignancy by diathermy applied through a suprapubic vesical incision. Of this number, 25 were free from recurrence at the time the report was made. Inasmuch as only short periods had elapsed in many of their cases at the time their paper was published, it does not seem safe to draw definite conclusions concerning the prognosis. They state that one of their patients was operated upon "more than three years ago."

Certain points in the technic employed are of interest. If the tumor is a large, arboraceous one, a multi-spiked electrode is first applied to it and a heavy shower of sparks is thrown over its surface, thereby producing coagulation or carbonization before the deeper portion of the growth is attacked. By this procedure bleeding is prevented during the later stages of the operation and the danger of implantation of any detached tumor fragments is prevented. If the tumor is pedunculated, its seared top is grasped with forceps and pulled forward, after which the pedicle is severed with a galvanocautery. The resulting stump and adjacent area are then coagulated with a stamp-shaped electrode. If the tumor is dendritic, but without a well-defined pedicle, the initial sparking is done with a single-spiked electrode. The sparks emitted from the latter cover a smaller area than those from the multi-spiked instrument, but penetrate more deeply. After the tumor has been thoroughly burned, the stamp-shaped electrode is applied for the purpose of coagulating its base. Burning is continued until a dry crust is formed and no oozing of blood can be seen. As a rule, this crust is white, but if the tumor is very vascular, it will be black in color. The electrodes are never pushed into the tumor mass. Sessile infiltrating tumors are treated solely with the stamp-electrode without any preliminary sparking.

The authors devote some space to a consideration of the extent to which coagulation should be carried out. In their early experience they considered it necessary to coagulate the entire tumor mass, but as they became more experienced they found that better results were obtained in the long run by not burning too deeply, leaving the undestroyed portion to the influence of the roentgen rays, which are applied in massive dosage forty-eight hours after the coagulation. With regard

¹ *Journal of the American Medical Association*, May 27, 1922.

² *Surgery, Gynecological, and Obstetrics*, November, 1921.

to this subject, it has been found that if a malignant growth which involves the vesicorectal septum is completely coagulated, a cloaca will remain after the incinerated mass of tissue has sloughed away. Such a sequel will not only be very distressing to the patient, but will, in all probability, lead to renal, or even general, septic infection. Preoperative irradiation is not considered advisable. The authors also advise against the use of radium in these cases.

Corbus¹ publishes an interesting article on treatment of CANCER OF THE BLADDER BY DIATHERMY, not only describing his technic, but also reporting some experiments which he carried out upon dogs with the assistance of V. J. O'Connor.

With regard to the former, the following considerations are of importance: First, the table is covered with several layers of thin paper over which is placed a rubber sheet $\frac{1}{8}$ inch thick, which must extend up to the head-piece of the table to insure perfect insulation. Over this a heavy woollen blanket is placed. The operator and his assistant should stand on wooden platforms which are covered with paper and strips of rubber $\frac{1}{8}$ inch thick. The indifferent electrode consists of a piece of blocked tin about 5 or 6 inches square, and is placed under the patient just above the buttocks. Between the electrode and the patient's skin a gauze sponge wet with hypertonic salt solution is placed, for the purpose of lessening the danger of superficial burning. This gauze should be wet from time to time during the operation. The author advises that the area of skin which has been in contact with the indifferent electrode should always be examined after the operation to determine whether any burning has taken place. If the operator uses a head-light, he should take the precaution to have the current supplied from a storage battery. Ether should not be used if it can be avoided, because of the danger of combustion, or of short-circuiting of the current. Rubber, instead of metal, retractors are employed, as the former are non-conductive. The active electrode consists of a piece of rubber through which there is a metal core. The conducting cord of the high frequency machine screws into its proximal end, while the electrode fits into the distal extremity. The kind of electrode used depends upon the size of the growth and its situation. Corbus has found that a Barnes' bag placed in the rectum is of considerable assistance in exposing the area to be treated. Furthermore, it acts as a sheath to protect the rectal wall. Another device employed for the protection of the bladder wall is a glass speculum, which is placed over the neoplasm, and through which the active electrode is passed. If the tumor is large, the speculum is applied to one area after another, each being destroyed in succession. The tumor is thoroughly coagulated. After the electrode has been applied for a certain length of time, bubbles of gas and steam are given off and cracking sparks jump from the sides of the electrode to the adjacent tissue. This occurrence indicates that the area receiving the application has been sufficiently burned. The suprapubic wound is kept open during convalescence, the author employing

¹ Surgery, Gynecology and Obstetrics, November, 1921.

the method devised by Pilcher, previously described in this Review, for making his preliminary cystotomy in the two-stage operation of prostatectomy. The suprapubic fistula not only places the bladder at rest, but also makes it possible to observe the tumor mass by suprapubic cystoscopy, and to permit the application of radium, if it be desired, as a supplementary treatment.

The animal experiments are very interesting. They were performed upon dogs deeply anesthetized with chloroform and were carried out under the strictest aseptic precautions. The results of these experiments show that the normal bladder wall subjected to diathermy is followed by distinct and uniform tissue reaction. The important effect is the slow coagulation of the underlying tissues, the effect upon the deeper structures being the same as that upon the mucosa. This is followed by an aseptic death of the submucosa and muscularis. Round-cell infiltration is marked only for the first three days. Eventually, the entire area is replaced by a dense proliferation of fibrous tissue, the line of demarcation between the treated area and the surrounding normal tissue being definitely preserved. The ureteral wall may be burned back almost to the entrance of the intramural portion. Three dogs so treated and kept under observation from three to five months showed no derangement of function either in ureteral activity or contractility of the bladder. No obstruction to the ureteral outflow occurred in five months. This burning back of the ureter is advised in connection with the removal of neoplasms situated around the ureteral orifice.

RADIUM IN CANCER OF THE BLADDER. From an experience with 24 advanced cases, G. G. Smith¹ concludes that it is hopeless to attempt to cure cancers which infiltrate large areas of the bladder wall, because any dosage which might influence the tumor will cause necrosis of the bladder. In superficial growths benefit has been obtained, in the sense that the neoplasm has become smaller under the application of screened radium emanation. The optimum dosage is 400 millicurie hours, with screening through 0.5 mm. of silver, applied not oftener than once in six weeks. The best mode of application is by the implantation of pure emanation tubes in the tumor, allowing one tube to each cubic centimeter of the growth.

Cystography. Roentgenographic and fluoroscopic examination of the bladder after it has been injected with materials more or less impervious to roentgen rays, is a diagnostic method concerning which Neil Moore,² of St. Louis, has recently recorded his experience. In *PROGRESSIVE MEDICINE* some years ago attention was called to the value of cystography in examining children. At that time the small caliber cystoscope had not come into general use.

Moore has found this method of the utmost value in ascertaining the size, shape and position of the bladder; the number, size, shape and position of the vesical diverticula; and in the diagnosis of hydroureter with disturbance of the mechanism of ureteral closure. Furthermore,

¹ Surgery, Gynecology and Obstetrics, November, 1921.

² Journal of Urology, August 1, 1922.

he believes it to be of great value in the diagnosis of calculi in the posterior urethra and prostate, some vesical calculi, and those tumors of the bladder of such dimensions that a correct idea of their size, shape and position cannot be ascertained by means of cystoscopy. In those old men affected with hypertrophy of the prostate, whose general condition is such that cystoscopic examination is likely to upset them, he expresses the opinion that much useful information can be obtained by cystography.

Materials in general use for injecting the bladder are solutions of sodium bromide or sodium iodide, 5 to 20 per cent, and thorium nitrate, from 5 to 15 per cent; emulsions of organic silver salts; and gases, such as air and oxygen. Moore favors 10 per cent sodium bromide solution, although he states that it does not give as clear a shadow as silver iodide emulsion. He has found that the silver emulsions in general precipitate so rapidly that the precipitate may cast a shadow. The technic of injection and exposure is described in detail.

DISEASES OF THE PROSTATE.

Carcinoma. The increased interest aroused in the prevention and control of malignant disease, as the result of efforts made by societies founded for that purpose, is manifest in present-day surgical and medical literature. Not only is the importance of early diagnosis and the therapeutic possibilities depending thereon generally better understood than they were a decade ago, but new methods, surgical as well as those in which physical agents are utilized, are being tried by a constantly increasing number of members of the medical profession. Concerning the physical agents, it may be stated that the interest centers in radium. Its application in malignant disease of the prostate has furnished material for several reports during the last year. Among the number may be mentioned first those of H. G. Bugbee¹ and B. S. Barringer,² of New York. Other important contributions to the subject have been made by Young and Deening; Geraghty, Chute, G. G. Smith and Bumpus. All will receive notice in the pages that follow.

The enthusiasm which marks the reports of certain writers on radium therapy in malignant disease of other organs and systems of the body is absent from those here referred to. Hopefulness, together with willingness to judge from actual results rather than from preconceived ideas, shows a healthful mental attitude.

Bugbee states that although his early experiences were not encouraging, he has obtained better results during the last few months by use of radium than he has ever been able to obtain by other means. Early in his experience applications were made through the rectum and urethra, and while the carcinomatous growth was frequently softened and reduced in size, the local irritation was also often increased and the patient suffered considerably from toxemia. More benefit has been derived from exposure of the prostate through a suprapubic cystotomy and introduction of the radium needles directly into its sub-

¹ Journal of Urology, December, 1921.

² Surgery, Gynecology and Obstetrics, February, 1922.

stance; and also in certain cases from the passage of radium needles into the prostate through the perineum. A series of 17 cases is reported, 5 of which were treated according to the last named method, supplemented by direct application to the rectal surface of the prostate. In 4 cases intraurethral applications were also made. At the time the report was published, no hard tissue could be palpated through the rectum in 3 of these patients. In one a single firm nodule, much reduced in size, was still present; and in the other a rapid softening of the extensive infiltration was taking place. In 4 cases application was made through a suprapubic opening and needles were also passed through the perineum into the gland. Rapid shrinkage of the tumor took place in all these cases. In 1 patient, who received surface applications of radium in conjunction with the above-described treatment, healing of the suprapubic opening took place. In 2 cases improvement followed the punch operation and the application of radium. Attention is called to the necessity of getting patients into the best possible physical condition before radium is applied. Elimination must be active and the blood index good if cancerous tissue is to be destroyed and eliminated without producing profound toxemia. The author states that the toxemia is now not nearly so severe as that which he observed in his earlier cases.

In this series 4 patients were in such bad condition that nothing but suprapubic drainage was attempted. In 1 other case prostatectomy, with resection of the bladder wall, followed by radium, was performed, and in still another, the treatment was confined to the insertion of radium needles through the perineum.

Barringer's report is based upon the study of 145 cases in the Memorial Hospital, New York. He states that the technic first used, and which was described in *PROGRESSIVE MEDICINE* a number of years ago, has given him better results than that obtained by any other method of application. It consists in passing radium needles into the prostate through the perineum, novocain anesthesia being employed to render the procedure painless. The needles are from 10 to 15 cm. long and of No. 18 gauge. From 50 to 100 millicuries of radium are placed in the terminal 3 cm. of the needle. It has been found that a carcinomatous mass 2 cm. in diameter may be first treated from 300 to 400 millicurie hours. In two or three months the second application is made, the dosage, however, being smaller. In certain cases from 25 to 50 millicuries have been applied every week, but the author has not found that the results obtained are superior to those following the larger dosage at longer intervals.

If the seminal vesicles can be reached, they are irradiated in the same manner. If the prostate, however, is so large that they are not easily accessible, an application may be made to them through the rectum. A finger is inserted into the rectum and a small cannula is passed alongside it until the vesicle is reached, whereupon the needle is passed through the cannula and pushed onward into the vesicle. It is stated that no infections have followed this method of application.

The use of radium in the prostatic urethra has been limited to cases

in which carcinoma has broken through its wall. Tubes of screened radium 2 cm. long are attached to a linen thread and inserted into the bladder through the sheath of a urethroscope. Then the urethroscope is removed and the tubes pulled out into the prostatic urethra by the attached thread. When the treatment is finished, the tubes are pulled out of the urethra in the same manner. The maximum dose is 200 millicurie hours.

If residual urine gives rise to serious symptoms, bare tubes of radium are applied to the vesical neck. A tube containing 6 millicuries of radium is placed in the end of a flexible needle which is passed through a McCarthy urethroscope or an operating cystoscope. By means of a plunger, the bare tube is pushed out of the needle into the prostate and left there. Its action is local and caustic. If the urinary symptoms are not relieved and the quantity of residual urine reduced by this treatment, a punch operation, suprapubic drainage, or partial suprapubic prostatectomy is performed.

Barringer's statistics show the hopelessness of many cases of carcinoma of the prostate. Although 1 out of 7 of his patients came under observation within the first two months after the appearance of symptoms, 1 out of 3 within six months, and 2 out of 3 within the first year, in each and every case the disease had extended beyond the gland. In only 2 per cent of cases forming this series was the disease apparently confined to the prostate itself. In view of these circumstances, routine examination of the prostate in all men more than fifty years of age, irrespective of the existence of symptoms, is recommended as the only rational method by which an early diagnosis of prostatic carcinoma can be made.

In conclusion the author states that he considers radium treatment to be superior to operative removal of the carcinomatous prostate.

Young and Deeming¹ have also published articles upon the radium treatment of prostatic carcinoma, the former describing the technic and the latter recording the results obtained in a series of 100 cases. Young has devised an applicator which shortens the period of application, so that 200 milligram hours can be given in an hour's time. This applicator carries two tubes of radium, each containing 100 mg. in its beak. They are placed end to end and are thoroughly screened with 2 cm. of platinum and a thin layer of gutta percha. The author states that with this exception the only modification that has been made during the last four years is to avoid making an application twice in the same place. The successive treatments should be given in different areas as far apart as possible and alternating between the rectum, urethra and bladder. With regard to rectal applications, it has been found possible, by means of the technic in which the radium is placed in position with the finger in the rectum and held there by the cystoscopic clamp, to give as many as twenty treatments of one hour each. No burning has been produced by this method. Needling of the perineum has been used in conjunction with the other methods. No local

¹ Surgery, Gynecology and Obstetrics, January, 1922.

anesthetic is required in the rectum, but an injection of 4 per cent procain is made before the applicator is passed into the urethra and bladder. A hypodermic injection of $\frac{1}{6}$ gr. of morphine half an hour before treatment has been found serviceable in patients who complain of pain.

Deeming's paper shows the results obtained at the Brady Institute in 100 cases treated with radium. All of the patients were suffering from advanced and extensive lesions which contraindicated surgical intervention. Relief of symptoms was obtained in 75 per cent of the cases, 3 patients remained free from symptoms and increased growth of the neoplasm for more than four years, and there were a number of others who, upon rectal examination, presented a condition of the prostate which did not resemble cancer. There were 23 patients who did not react to treatment, but a study of their cases shows that the average amount of radium given was only 625 milligram hours. The average for those receiving at least some improvement was 1415 milligram hours. Thus, it is only fair to assume that failure to obtain results in the above-mentioned group of cases, was due to the fact that insufficient dosage was employed. The opinion is expressed that from 4000 to 5000 milligram hours in a period of six to eight weeks should be given, and in addition needle treatments of 500 to 2000 milligram hours should also be made through the perineum.

H. C. Bumpus, Jr.,¹ of the Mayo Clinic, calls attention to the fact that the relative degree of malignancy, as shown by the character and arrangement of the epithelial cells, affords an index to the prognosis. Thus, if the proliferating cells are partly differentiated, fairly regular in size and shape, and retain the characteristic long tufted ends, the prognosis with regard to the duration of life is better than it is in those cases in which the epithelium shows little or no tendency to simulate the normal type and is irregularly dispersed through the fibrous tissue.

A very important point is made by Bumpus with regard to the surgical treatment of carcinoma of the prostate. Eleven per cent of the patients in a certain series who were treated surgically are living at the end of six years, and 9 per cent are alive at the expiration of nine years. In contradistinction to those who were operated upon, all in another group who were not operated upon had succumbed at the end of six years. As the author remarks, this shows that it is possible occasionally to remove all the malignant cells by conservative surgery. Undoubtedly, many of those who were not operated upon were in such a condition as to render surgery useless. Although it might seem only fair to assume that as much could have been done surgically for some of them had they come for treatment earlier as was done for those in the former series, certain figures submitted by Bumpus show that there was little difference in the final results obtained in the cases constituting the two groups. In the former, in which operation was done for suspected malignancy, 34 per cent of those who died succumbed the first year, and in the latter, in which a positive diagnosis of malignancy could be made, 35 per cent succumbed the first year. The

¹ Surgery, Gynecology and Obstetrics, August, 1922.

average length of life of patients in the early cases was about twenty-six months, those in the later cases twenty-seven months. In both groups only 9 per cent of those who died had lived more than three years. Thus it would seem that the degree of malignancy is the determining factor in the prognosis. Both the perineal and suprapubic operations were performed. Slightly better results were obtained in the suprapubic cases.

In a series of 200 prostatectomies performed by Arthur L. Chute,¹ of Boston, it was found that the enlargement was malignant in 17.5 per cent of the number. In reporting these cases, Chute discusses the advisability of surgical intervention, and expresses the opinion that in all instances where the growth is producing obstruction to urination, an attempt should be made to remove it unless the patient's general condition is too precarious to permit an operation. In some cases he has found that the pain in the sacral region or thighs has been temporarily relieved by removal of the growth. In such cases, of course, the indications for operation are less clear than when there is urinary obstruction, and if there is any reason to believe that the pain is caused by metastatic involvement of the spine, no operation should be undertaken. The patients upon whom the author has operated were apparently suffering because of lateral extension of the disease, which produced pressure upon nerves a considerable distance beyond their exit from the spine.

Three operative methods have been found useful by the author. Removal by suprapubic enucleation is considered applicable only in those cases in which the growth is intracapsular. In the majority of cases in which the author employed it, the type of disease was not recognized until the time of operation. In cases in which preliminary suprapubic drainage has been made and the prostate is so dense and firmly attached that it cannot be enucleated from above, combined suprapubic and perineal removal is advised. This was satisfactorily employed six times. All malignant tissue possible is cut away or punched out through a median perineal incision under guidance of the forefinger introduced through the suprapubic wound. In the majority of instances the best procedure is one resembling Young's perineal operation for removal of the adenomatous prostate. Chute employs the classical position, incision and dissection of the perineum until the prostate is reached; then he makes a transverse incision into the prostatic tissue which permits the turning back of a flap, thereby aiding in the protection of the rectum from injury. Removal of the diseased tissue is accomplished by the finger, a dull periosteal elevator and rongeur forceps. Special attention is given to the removal of the dense tissue that surrounds the vesical outlet. For this purpose curved scissors have often been found useful. Drainage is established by means of a catheter in the urethra and perineal tubes in the wound. Radium needles are now being inserted into any particles of suspicious tissue that cannot be taken away. Ordinarily they are left in place from

¹ Boston Medical and Surgical Journal, October 27, 1921.

twenty-four to forty-eight hours. The dose of radium has usually been 25 mg. This combined procedure was carried out in 26 cases, in 7 of which spinal analgesia was used.

The author states that convalescence in cases of this kind is not different from the convalescence following ordinary prostatectomy for benign disease. That the ultimate results would be very disheartening if they applied to anything but a condition that is inevitably fatal, is freely admitted by the author. He feels, however, that the relief given the patients, together with a certain prolongation of life, fully warrants the use of the methods which he describes. The hope is expressed that the use of radium as an adjunct to surgical treatment will give better results than have been obtained in the past.

Geraghty¹ devotes considerable space to a study of this subject, based upon the cases from Johns Hopkins Hospital, and concludes that in 95 per cent of all cases it is impossible to accomplish total removal of the growth. Thus, complete removal was possible only in 21 out of 400 cases. In 14, Young's radical operation for carcinoma was done, resulting in the cure of 50 per cent, while in 7 total prostatectomy was performed, which resulted in a cure of the entire number.

During the last seven years radium has been used in the treatment of malignant disease of the prostate, either alone or supplementary to surgical treatment. During the earlier part of that period the technic consisted in applying 100 mg. for one hour and repeating the application every second or third day. The application was made through the urethra and rectum. For the last year and a half 12.5 to 20 mg. have been inserted into the prostate by means of needles passed through the perineum and left in place from fifteen to thirty hours. As the result of this treatment, in some cases at least, the prostate became smaller and somewhat softer, but the symptoms of obstruction were not much influenced. Some patients so treated had to have a prostatectomy done to relieve them of urinary symptoms. The author remarks that in every case operated upon after the employment of radium, distinct cancer tissue, apparently unchanged, could be found in the removed gland. As a rule, the patients in this series did not come under observation until the disease had involved the seminal vesicles or the posterior bladder wall, a circumstance which accounts for the small number of radical operations attempted.

Thomas and Pfahler² recommend preoperative treatment with the roentgen rays extending over a period of about two weeks. The area treated includes the entire pelvic region, the object being to destroy any outlying carcinomatous foci in the lymphatics and to temporarily limit the extension of the disease. The insertion of radium needles into the prostate through a suprapubic opening is also recommended, each needle containing 10 mg. of radium. In some cases the prostate has been exposed through the perineum, as much removed as possible and radium then applied, this method thus conforming in principle with that advised by Chute. At least two full doses of roentgen ray

¹ Journal of Urology, January, 1922.

² Archives of Surgery, April, 1922.

are given after operation, the first about two weeks after the radium application and the second three or four weeks later.

Hypertrophy of the Prostate. In an article entitled "Some Disputed Points Regarding Prostatectomy," Chute¹ discusses, among other things, overdistention of the bladder, and also mentions 10 men who died without being operated upon as the result of this condition and the back pressure it exerted upon the kidneys. He states that he could not, by any means, get them into proper condition for operation. It was evident that some of them were critically ill upon admission; others, however, seemed to be in fair condition, although the latter group as well as the former, failed to improve under the measures instituted for their relief. In no case was immediate removal of the prostate attempted, suprapubic drainage under local anesthesia being the only operative procedure employed. It is evident that the author's experience in this respect coincides with that of many others who have had patients die while waiting to do the second step of the two-stage operation. Chute prefers suprapubic cystotomy to catheter drainage in this class of cases, believing that the increased shock of the suprapubic incision is more than offset by the better drainage obtained.

The phthalein output as an indication of operability is also discussed, and the author expresses the opinion that as an index of renal activity at the moment the test is made it is very dependable. However, as it cannot give any information concerning of the potential power of the kidneys, he feels that it cannot be of any help if performed only once. When a kidney has been embarrassed by the back pressure of a distended bladder, as in this class of cases, it will eliminate only a trace of phthalein. After the pressure has been removed by drainage, its function will improve and a fair output can be obtained after a few weeks.

At this year's meeting of the American Association of Genito-Urinary Surgeons, a *new method of performing perineal prostatectomy*, for the purpose of securing better functional results, was described by Geraghty,² of the Johns Hopkins Hospital. The author admits that perfect urinary control following the usual perineal prostatectomy is to be expected only in cases in which the prostate is small or only moderately enlarged. In cases in which the gland was greatly enlarged, he has found that partial incontinence of a few months' duration, or occasionally permanent incontinence, follows the usual perineal operation.

The author's method is different from Young's in that he does not expose the membranous urethra at any time, and consequently does not injure its musculature nor disturb its nerve supply. It is well known that incontinence rarely follows suprapubic prostatectomy, a circumstance which the author states prompted him to investigate the occurrence of the temporary incontinence not uncommon after the perineal operation. In the latter, as usually performed, the external sphincter is either dislocated or divided before the membranous urethra

¹ Journal of Urology, June, 1922.

² Ibid., May, 1922.

is opened, and it is to this circumstance that the faulty functional results are attributed. If the membranous urethra is opened without stripping off the surrounding musculature, the fibers of the external sphincter must be divided; if, on the other hand, the muscle which encircles it is dissected forward or backward, considerable injury to this muscle may result. The author's technic was designed for the purpose of obviating this defect. The operation is described as follows:

The patient is placed in the usual exaggerated perineal lithotomy position. A specially constructed prostatic tractor is passed from the meatus into the bladder, the blades of the tractor opened and the handle carried toward the patient's abdomen. This tractor, devised by Henry Freiberg, differs from the Young seminal vesical tractor in possessing a curve and shape which facilitates its introduction into the bladder. It, furthermore, upon the opening of its blades, so engages the prostate that its flat surface rather than the sharp edge is in contact with the gland. This position of the tractor, using the symphysis as a fulcrum, forces the prostate forward toward the perineum. In the next step of the operation a semicircular perineal incision is made, its center being about an inch anterior to the anal margin. The ischio-rectal fossæ are now opened with the finger and a bifid retractor introduced, each blade of the retractor occupying a fairly deep position in the fossa. When retraction is made, the central tendon is rendered tense and prominent. This structure is then divided close to the bulb, its division exposing the rectum. The rectum is now seen covering a varying amount of the posterior surface of the prostate and the rectourethralis is seen holding the under surface of the bulb to the rectum at a point close to the apex of the prostate. To facilitate the stripping back of the rectum, a finger is introduced anterior and lateral to the apex, the free margin of the rectum being readily picked up at this point. The rectum is now easily and safely freed from the prostate by finger dissection. By blunt dissection the fibers of the levator ani are now separated in the midline in the region of the apex of the prostate. The anterior fibers are now pushed laterally, while those covering the body of the gland are pushed backward. The smooth, glistening visceral layer of Denonvilliers' fascia is now exposed. It is evident from the foregoing description that the membranous urethra is not exposed and that its musculature is left undisturbed.

A curved incision is now made through the posterior layer of the prostate, the point of the curve being at the apex of the gland and the legs extending downward in a divergent manner. The form of this incision preserves a flap containing the ejaculatory ducts, and, furthermore, gives a maximum exposure of the hypertrophied lobes beneath. The line of cleavage between the capsule and the adenomatous masses is effected by the blunt dissector and the subsequent dissection is carried out by the finger as is done in the suprapubic enucleation. The finger is carefully and gradually insinuated between the two layers, the anterior or apical portion of the lobes being delivered first. This facilitates the subsequent removal of the deeper portions of the gland, especially the part which lies within the bladder. After the delivery

of the apical portion of the lateral lobes, these portions are grasped with forceps, by means of which traction is readily made. The sub-urethral and intravesical lobes are then carefully freed from their posterior attachment and from the grasp of the internal sphincter. If, following the removal of the adenomatous mass, which is usually possible in one piece, unusual bleeding takes place, the edge of the mucous membrane is grasped with forceps and any bleeding vessels ligated. A large single tube is now introduced into the bladder through the opening in the prostatic capsule and long strips of gauze are packed tightly around it up to a point well within the vesical orifice. The prostatic cavity is next snugly packed, the gauze being guided into its proper position by the finger.

It is well recognized by prostatectomists that the most serious hemorrhage following prostatectomy arises from large vessels which lie in the overhanging flap of the bladder wall from which the prostate has been separated. If care is not exercised in packing from the perineal side, this lip of bladder wall may be everted into the bladder cavity, and no hemostasis will be effected at this point by pressure of the pack. Such an accident may be avoided by grasping the edge of the overhanging lip of the bladder wall with a mucosal clip, thus fixing it until the gauze pack has been inserted between the tube and vesical orifice. The observance of this technic will prevent eversion of the torn edge of the bladder and possible serious intravesical hemorrhage.

The tube is now sutured into the skin edge with heavy silk and the remaining portion of the skin incision approximated with subcuticular chromic catgut sutures.

Young¹ has recently described a modification of his perineal operation which permits enucleation of the entire adenomatous mass in one piece without injuring any important anatomic structures. After the prostate has been exposed through the usual superficial incision and the prostatic tractor has been introduced, an oblique incision is made along the left side of the tractor where it enters the prostatic urethra and is continued thence backward and slightly outward nearly to the posterior limit of the prostate. The whole prostatic urethra is thus widely opened, and the author states that the verumontanum can be plainly seen along the floor of the urethra to the right. An incision is then made along the mucous membrane of the urethra, covering the inner surface of the right lateral lobe, and enucleation of the lateral lobe is performed by means of the blunt dissector and the index finger. The mucous membrane covering the middle lobe is then divided transversely, the ejaculatory ducts and verumontanum being pushed backward and guarded by the index finger, which is inserted along the floor of the urethra until it reaches the middle lobe. An incision is next made with the scalpel or finger-nail through the mucous membrane covering the median portion of the prostate, after which the finger is pushed backward beneath the middle lobe, thus freeing it from the

¹ Journal of the American Medical Association, April 1, 1922.

proximity of the ejaculatory ducts posteriorly. Enucleation of the lateral and median lobes is then completed, first on one side and then on the other, until the entire adenomatous prostate is drawn forward and gradually separated from its attachment to the vesical and urethral mucous membrane. If there is a subtrigonal lobule, the tractor is removed and the index finger of the left hand is inserted through the sphincter into the bladder. The deep portion of the middle lobe is then removed upon this finger, a curette being used, if necessary, to free its deep portions from the surrounding structures.

Of late sacral anesthesia has received considerable attention by a number of prostatectomists, among whom may be mentioned A. J. Crowell,¹ L. A. Chute² and G. G. Smith.³ Crowell describes his technic as follows: A spinal puncture needle is inserted into the sacral canal through the triangular space formed by the sacral cornua at the sacrococcygeal articulation. It is then directed upward parallel with the sacral canal for 3 or 4 mm. and 30 cc of a 2 per cent solution of novocain is injected slowly in order that it may thoroughly infiltrate the tissues. Malformations of the spinal canal should be kept in mind and a moment allowed to elapse after the obturator is removed to see if the spinal fluid escapes. If so, the puncture should be made elsewhere. Twenty minutes should elapse after the solution is injected before the operation is begun. Blocking off the sacral plexus by this technic anesthetizes the entire external field of operation so that all manipulations are painless unless the traction necessarily made in many cases on the pelvic peritoneum causes some pain, in which case nitrous oxide may be required while enucleation of the gland is being performed. Crowell states that postoperative pain is greatly reduced by this method of analgesia.

Smith has employed sacral anesthesia in 10 cases and states that he is enthusiastic about it. In 8 of his cases the perineal operation was done, in 2 the suprapubic. In 1 of the latter the operation was completed without causing the patient any pain. The other case was that of a very nervous man, who had to have a little ether before the operation was over. Smith states that he was of a very nervous temperament, and expresses the opinion that at least a "psychic" ether would have been required in conjunction with any form of local anesthesia.

DISEASES OF THE PENIS AND URETHRA.

Epithelioma of the Penis. Eighteen cases of this form of malignant disease have been reported by Shreiner and Kress.⁴ In 3 radical operation was performed, although preliminary roentgen-ray treatment was employed. No metastases were found in these 3 cases. The operation consisted of amputation of the penis, together with removal of the testicles, scrotum and all lymph-bearing tissue in both groins. The patients were alive and well four, three and two years later respectively. Roentgen ray combined with radium was used in 2 cases, in 1 of

¹ Journal of Urology, July, 1922.

² Ibid.

³ Ibid.

⁴ Journal of Radiology, October, 1921.

which the result was unsuccessful. In the other case the patient was exposed to the unfiltered roentgen rays three times in six weeks, two erythema doses being given on each occasion. The large nodes in the groin were treated with radium, the filtration being through 0.5 mm. of silver, 1 mm. of lead, 1 mm. of aluminum and 1 cm. of rubber. A total application of 9700 millicurie hours was made to each groin. The lesions healed. Roentgen ray with conservative operation, consisting of amputation and removal of lymph nodes, was used in 2 cases. One patient was alive and well two and one-half years later, but the other died from recurrence a year later. Six patients were treated with the roentgen ray alone, the results being good in all these cases. One patient was alive and well six years after treatment.

With regard to the duration of the disease, it is stated that signs had been present from six months to two years before the patients came under observation. In 6 cases there were definite metastases to other regions of the body. In 12 there were palpable lymph nodes in the groin, although in 5 of this number microscopic examination of the nodes removed at operation failed to reveal any signs of malignancy. In all cases in which definite metastases were shown in the lymph-bearing tissues the treatment proved ineffective or at best only palliative.

The authors conclude that cancer of the penis can be healed with unfiltered roentgen rays, and that improvement in the technic, as well as earlier diagnosis and earlier treatment, may result in a greater number of cures than have heretofore been obtained. In those cases in which metastasis has already occurred in the lymph nodes, the implantation of small doses of radium emanations, supplanted by radium packs, has proved to be beneficial.

An important report on carcinoma of the penis, having special reference to *prognosis*, comes from Garre's¹ clinic, in Bonn, the report being made by W. Peters, an assistant surgeon in the clinic. It is based upon 25 cases and covers a period of thirteen years. Only those patients who remained free from recurrence for more than five years are spoken of as cured. Previous statistics show that this localization of carcinoma occurs in advanced life and that one-third of all cases begin during the sixth decade. As to the age incidence in this series, there were 9 cases in men between fifty and sixty years; 5 in those between sixty and seventy; 6 in those above seventy, and 5 in those under fifty. Examination of these figures shows that they do not differ essentially from those previously reported by various surgeons. Very few of the number were private patients, and, in discussing the etiology, the reporter remarks that uncleanly habits may have had some influence in the causation of the disease. Many of the patients were affected with phimosis. In 12 cases the lesion first affected the glans; in 9, the prepuce; in 3, the coronary sulcus; in 1, the undersurface of the penis close to the scrotum. Various periods of time had elapsed since the appearance of the lesions and the admission of the patients to the hospital. Thus 9 applied for treatment within less than six months from the

¹ Zeitschrift für Urologie, Band 15, Heft 10.

time they noticed the trouble; 9 went from six months to one year, and 5 allowed more than one year to go by before seeking relief. In the last group there were 2 who waited more than two years.

In discussing prognosis, the opinion is expressed that the duration of the disease cannot be used as a criterion of the outcome of the case. Thus, the 2 patients just mentioned, who waited more than two years before applying for treatment, are alive and well ten and thirteen years respectively after operation. In contrast to these, one patient, who was operated upon three months after the first appearance of the lesion, died two years later as the result of extensive metastases. In all cases in which metastasis to the lymph nodes was demonstrable, the lesions on the penis had not been present for more than six months. It is interesting to note that in 17 cases in which the inguinal glands were removed, carcinoma was demonstrable microscopically in only 2. As the author remarks, some error in the reports very likely occurred because the pathologists could not possibly make serial sections of each and every gland. This finding is at variance with the microscopic findings in other series of cases.

The results obtained in this series may be tabulated as follows: Three patients died after the operation—1 from pyelonephritis, 1 from pulmonary edema and 1 from pulmonary embolism. Three others died from metastases—1 a year after operation, 1 two years afterward and 1 eight years afterward. The last-mentioned was eighty-seven years of age. Death was reported to be due to carcinoma of the bladder and pelvis. Five others died of intercurrent affections at periods varying from four to nine years after operation. There were 14 remaining free from recurrence and metastasis at the time the report was published. Ten of the number have passed the five-year limit and 6 have remained entirely free from nine to thirteen years.

Of great interest is the question whether extensive removal of all the regional lymph nodes exerts any special influence upon the end-results. In 8 cases of the series no inguinal dissection was made because the patients would not consent to it. One of the number died within a year from metastasis. Another succumbed to the same condition in a little more than a year. Four showed no signs of metastasis at the time the report was published. The other 2 died of intercurrent affections eight or nine years respectively after operation. Despite the excellent results in half of these 8 cases, the author is unwilling to admit that the removal of the inguinal nodes, even when they are palpably enlarged, is a superfluous procedure. In all cases in which the lesion on the penis increased rapidly in size, and in which there is evidence of extension to the corpora cavernosa and early enlargement of any regional nodes, he feels that the most extensive operation possible is in order. In this connection the procedure of Cunningham, of Boston, is mentioned. The importance of clearing out the inguinal region even when the nodes are not palpably enlarged is shown by one of the cases—that of a man who would not consent to an inguinal dissection. He came back six months after operation free from local recurrence, but presenting a large mass in one groin. It was removed and found to be

carcinomatous. The patient was seen six months later, at which time he had inoperable metastases in the pelvis.

The management of inoperable cases is also discussed and palliative operation, consisting of amputation of the penis and removal of accessible lymph nodes, particularly those in the groin, is recommended. The roentgen rays have not been used in this class of cases. The author stated that it is a dictum in Garre's clinic that that which is operable is operated upon.



FIG. 2.—Penis incased in condom. Lines of incision. Abdominal and inguinal fat mass partially freed. (Cunningham.)

Cunningham,¹ at a recent meeting of the New England branch of the American Urological Association, showed 2 patients upon whom he had operated according to his radical method. Both of these patients had been subject to chronic irritation, 1 having suffered from phimosis since birth, the other having been subject to warts beneath the prepuce and having had repeated cauterizations performed for their removal.

¹ Transactions of the New England Branch of the American Urological Association, Winter 1921. *Journal of Urology*, June 6, 1922.

In showing these patients, Cunningham took occasion to describe the technic of his operation, which is as follows:

1. A condom is placed over the penis to prevent implantation of cancer cells during the operation.

2. A sweeping U-shaped incision is made, beginning slightly above and to the inner side of the anterior-superior spine on one side, extending downward in the fold of the groin to the root of the penis and upward on the other side. This incision passes just through the skin (Fig. 2) and outlines an apron which is dissected upward.



FIG. 3.—The scrotum partially bisected. The dorsal veins tied. The crura separated from the pubic rami and their stumps tied. The membranous urethra separated from the bulb. The abdominal fat mass above. (Cunningham.)

3. An incision, passing through the skin, is made downward over Scarpa's triangle from the center of Poupart's ligament. The skin is dissected inward and outward making two flaps (Fig. 2).

4. Beginning at the top of the abdominal incision, the fat which contains the lymphatic channels is dissected in one mass from the abdominal fascia. This dissection is carried downward into Scarpa's triangle on either side. The superficial nodes are removed still imbedded in the fat if possible. Hemorrhage during the abdominal portion of the

dissection is slight, but as the dissection is carried over Poupart's ligament into Scarpa's triangle, the superficial epigastric, the superficial circumflex and the superficial external pudic vessels must be secured beneath the fat mass as they come through the fascia. If the node involvement is marked, the growth may extend as one mass through the fascia lata into the deep inguinal nodes, in which event the fascia is divided. The sartorius is drawn outward if necessary and the involved nodes freed from the femoral vessels. Poupart's ligament may be divided in order to continue the dissection into the crural canal. If the mass is not continuous from the superficial to the deep nodes, the fascia lata is divided and the deep nodes freed from the femoral vessels and removed.

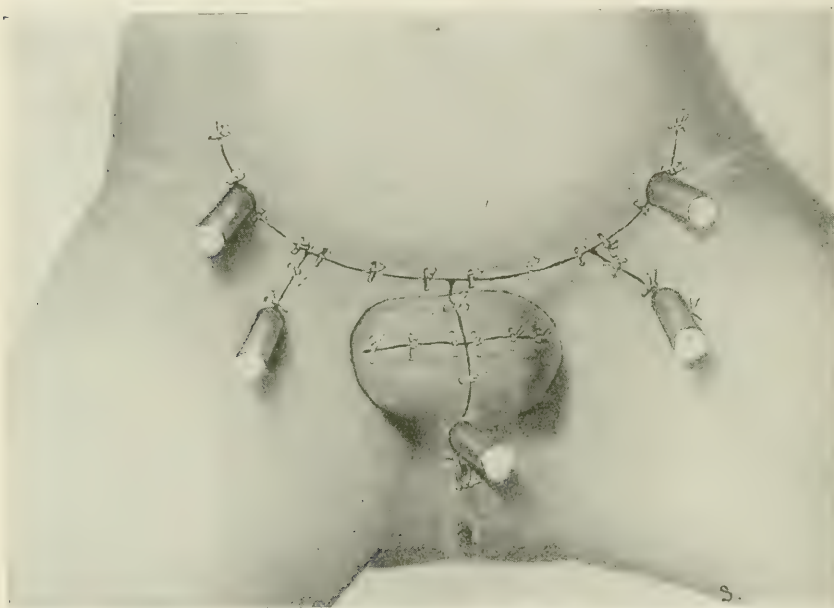


FIG. 4.—The wound closed by drainage. The urethra stitched in the perineum. The serotal wound partially closed in the line of incision and partially by converting the incision into a lateral wound. (Cunningham.)

5. The patient is then placed in the lithotomy position. An incision is begun at the root of the penis, passing around both sides, uniting beneath and continuing along the raphé of the scrotum, bisecting it. The suspensory ligament is divided and the dorsal vessels of the penis secured. The penis with the attached fat-mass from the abdomen and groin is drawn downward. The dissection is carried on until the attachment of the crura to the pubic rami are met. These are clamped close to the bone and cut away. The stump is transfixed and tied and no hemorrhage results (Fig. 3). It is necessary to clamp, transfix and tie, for the arteries to the crura may otherwise retract and cause troublesome hemorrhage. Then the corpus spongiosum is freed at a distance of about $\frac{3}{4}$ inch in front of the bulb and cut across at this

point, unless the membranous urethra seems sufficiently long. It is better to leave too much than too little urethra. The whole mass, the abdominal and inguinal fat containing lymphatics and nodes, the penis and the crura, are then removed in one piece.

6. The cut end of the urethra is then stretched to the lower part of the perineal incision, leaving about $\frac{3}{4}$ inch protruding beyond the surface. This is cut away about ten days later after the incision has closed. In this way stricture is less likely to result. A self-retaining catheter is placed through the urethra into the bladder. A drain is placed in the perineum, also in the wound of the abdominal skin-apron on either side, and in the incision in both Scarpa's triangles (Fig. 3).

7. The suturing of the scrotum, so that it is lifted upward, and will not become soiled by urine, is important.

Primary Tumors of the Urethra. Five cases of solid tumor occurring primarily in the urethra have been treated at the Mayo Clinic and form the basis of a study of such neoplasms by Scholl and Braasch.¹ Of the 5 tumors, 4 were malignant and 1 was benign. The majority of malignant growths of the urethra are of epithelial origin and consequently it is not surprising that chronic irritation and trauma play a role in their production. A number of cases have been found in the literature in which chronic infection with its consequent tissue changes formed a foundation for the development of malignancy. It would seem that in some cases urethral carcinoma is preceded by a long period of urinary difficulty, although in others, particularly those in young men, its development may be rapid. It is stated that in one case the patient had trouble only three weeks before a definite area of malignancy was discovered. Traumatic strictures have the same malignant potentialities as those of infectious origin. A number of cases of this kind are cited. Malignancy may also develop around the edges of a urinary fistula. With regard to the age incidence, the majority of cases which follow long-standing infection occur in men of middle life and the neoplasm is usually situated at the site of a stricture. Most of these tumors have a histologic structure similar to that of squamous-cell epithelioma of the penis, though of a higher degree of malignancy. In young men the papillary type is more common. They infiltrate the surrounding tissues rapidly and give rise to remote metastases, which are not common in the squamous-cell type. In the latter, metastases show a tendency to remain confined to the primary lymph nodes.

The case of a man with carcinoma of the urethra which followed a long-standing urethral stricture is reported. He was forty-eight years of age and was admitted to the clinic in October, 1917. When a young man he had an attack of gonorrhea and for twenty years a urethral stricture requiring frequent dilatation. He had a set of urethral sounds which he used himself. For three months he had had difficulty in keeping the urethra open and had noticed a gradual swelling in the perineum. His general health was good. A hard, nodular

¹ *Annals of Surgery*, August, 1922.

mass 2 cm. in diameter was found in the perineum at the penoscrotal angle. The urethra was markedly obstructed in the region of the mass, but it was possible to pass a filiform bougie into the bladder. The stricture was dilated several times, but rapidly recurred, finally producing almost complete obstruction. At operation a growth 4 cm. long was found at the juncture of the membranous and anterior portions of the urethra. The involved area was completely excised. Later complete removal of the penis, testicles and inguinal lymph nodes was advised, but was refused by the patient. Microscopic examination showed that the growth was a squamous-cell epithelioma.

Six weeks after the operation the urethra was reconstructed from a segment of the internal saphenous vein. Two months later the wound had completely healed, save for a persistent perineal sinus. Three hundred and fifty milligram hours of radium were applied to the urethra in the region of the scar through the perineal sinus. The patient was alive at the end of five years. Whether or not there had been any recurrence was not ascertained.

Three cases of primary carcinoma of the female urethra are also reported. The majority of malignant tumors of the female urethra are squamous-cell carcinomas of a slightly higher type of malignancy than histologically similar tumors occurring on the cutaneous surface. They generally respond readily to radium treatment.

The classification of Whitehouse is adopted. He divides them into two types: (1) An irregular elongated ulceration involving only the mucous membrane of the urethral floor, usually occurring in the distal segment; and (2) periurethral tumor having a tendency to infiltrate surrounding tissue extensively and occlude the urethral canal. In the first type the growth is generally of a high degree of malignancy. In the second type ulceration occurs late and fibrosis and hyalinization are prominent features. The primary neoplasm may grow very slowly and cause only a few symptoms. Attention may be directed to the primary focus only by finding a metastatic growth.

The fifth case reported was one of fibroma of the female urethra. It occurred in a woman, aged twenty-six years, and had been present at least a year before she applied for treatment. There had been no urinary disturbance, but straining had often made the growth bleed. At operation an irregular, lobulated mass attached by a broad base to the outer half of the mucosa was dissected from the urethral canal. Histologic examination showed it to be made up almost entirely of fibrous tissue. Three years later the patient had not had a recurrence and was in good health.

Pomroy and Milward,¹ of Cleveland, report the case of a woman who was admitted to the hospital for a supposed vaginal hemorrhage, which had occurred at intervals for a period of five years. The patient was a colored woman who did not know how old she was, but who apparently was in the seventies. Examination revealed a condition which at first looked as though it might be a large carcinoma affecting

¹ Surgery, Gynecology and Obstetrics, September, 1922.

the cervix of a prolapsed uterus, but which, upon further investigation, was found to take origin from the external urinary meatus, whence it extended backward along the posterior wall of the urethra for about 3 cm. As above stated, there was also pronounced downward projection of the mass. No evidence of disease could be found in the vagina. The uterus, though senile, was in normal position and the cervix was free from ulceration. Upon being questioned further, the patient stated that there had been a small wart-like growth at the urinary meatus for a number of years before bleeding began. A small piece of the growth was removed, and was shown by microscopic examination to be carcinomatous. The pathologist expressed the opinion that the growth was a caruncle which had undergone malignant degeneration. Under ether anesthesia five radium needles, each containing 10 mg., were inserted directly into the tumor and allowed to remain for twelve hours. In addition one tube containing 50 mg. of radium, screened with 0.5 mm. of silver, 1 mm. of brass and 1 mm. of hard rubber was inserted into the urethral canal and allowed to remain for four hours. Twelve days after the application was made the mass had shrunk to one-third its original size. The authors quote Vernot and Parcellier, who, in 1921, were able to collect only 87 cases, including 1 of their own.

Hypospadias. In 15 out of 17 cases of this malformation, which came under Madier's¹ care, the defect involved the anterior portion of the urethra and was, therefore, considered proper for the von Hacker or Beck operation. In 13 cases a perfect result was obtained. One of the remaining 2 was a failure and in the other it was stated that "partial cure" was obtained. None of the patients operated upon was less than nineteen months of age. The author sets a desirable age limit at two and a half years, believing it is better not to wait until the children are older, lest erections may tear out the sutures. He describes his technic as follows. After the penis has been cleansed and sterilized with tincture of iodine, the prepuce is slit along its anterior surface and the two angles are clamped along the anterior abdominal wall, thereby fastening the penis so that the operative field will have a firm support. While an assistant carefully holds the skin, a rectangular flap 5 mm. in size is dissected up along the side of the urethra. The incision is then continued downward along the urethra, which is made tense, and finally dissected free. The extent of this liberation will vary in different cases, depending upon the distance of the unnatural orifice from the end of the glans. The next step in the operation consists in passing a bistoury into the hypospadiac opening and cutting out through the glans. Then the skin flap with the attached urethra is drawn through this slit and sutured in place by four interrupted stitches placed at the corners. The longitudinal skin wound is next closed after the two edges of the corpora cavernosa have been drawn over the buried urethra. No catheters are used and only a light dressing of sterile gauze is applied. About twelve days are required for complete healing.

¹ Journal de Chirurgie, September, 1921.

Niedermayr¹ reports 7 successful operations performed according to the Gesuny two-stage method, which he has found to obviate many of the technical difficulties of other methods. The first step consists of making an opening into the urethra through the perineum and suturing a catheter into the wound. By this means the penile urethra is kept free from urine.

The plastic operation is described as follows: Two straight parallel longitudinal incisions 1.5 cm. apart are made from the abnormal urethral opening up to the glans. These are united at their posterior ends by an incision encircling the urethral meatus, and the anterior end is lengthened for its passage through the glans by making a longitudinal flap on each side of the foreskin with its base at the strip of skin destined for the urethra. A transverse incision is then made on the under surface of the skin in the coronary sulcus, uniting both sides of the wound in the foreskin. From this point a subcutaneous canal is made under the glans, being carried as far forward as the site of the new urethral opening. Both flaps are then drawn through this canal and sutured to the edges of the new meatus. The bridge of skin on the dorsal surface of the glans is cut transversely, the skin freed and the wounds behind the coronary sulcus are united by circular incision.

A small transverse incision on the dorsum of the penis near its root is made and through it a dressing forceps is pushed until it appears behind the glans near the coronary sulcus. A traction suture previously placed over the scar-like band behind the glans on the dorsal surface of the penis is drawn through the canal thus made so as to bring the glans out in the upper opening near the symphysis. This carries the penis up toward the abdomen, to which it is temporarily fastened by sutures passing through the inner preputial flap.

In young children continuous catheterization is employed. In older ones the catheter is clamped and allowed to drain the bladder only as they feel the desire to urinate. At the end of two weeks the catheter is removed. In three or four weeks the penis is freed from the abdomen by a short transverse incision behind the glans and two longitudinal incisions toward the scrotum, including enough skin to cover the dorsum of the penis. A slight plastic operation may be necessary to close the cutaneous defect.

A plastic operation on the urethra by the use of a segment of the saphenous vein is reported by Riese.² The patient, a man aged forty years, had been operated upon in 1917 for a resilient stricture. In February, 1920, abscess and fistula developed. A few weeks later he came under Riese's care and on March 8, 1920, operation was undertaken. Through a perineal incision, firm cicatricial tissue, extending back to the neck of the bladder was found, but the urethra could not be isolated. Through a median suprapubic cystotomy a catheter was passed through the internal urinary meatus down into the membranous urethra, which was opened over the tip of the instrument. All of the cicatricial tissue was excised, after which a piece of saphenous vein

¹ München. med. Wehnschr., June 24, 1921.

² Deutsch. med. Wehnschr., September 22, 1921.

10 cm. long was introduced on a fine catheter and fastened both above and below by means of sutures. The suprapubic vesical wound was also drained. Urine was discharged through both catheters. After ten days the one in the urethra was taken out and ten days later the other was removed from the wound in the bladder. The bladder was irrigated once daily through a catheter passed into the incision. Twenty-four days after the operation boric acid was introduced into the urethra, whereupon it was found that there was a small fistula at the proximal end of the implant. A retention catheter was again introduced. At the end of five days urination was normal without any discharge of urine through the perineum. The patient left the hospital three and a half months after the operation. At the end of a year a 17-French could be passed.

This method was reviewed in *PROGRESSIVE MEDICINE* a number of years ago, and occasionally since that time cases have been recorded in the literature. Riese expresses the opinion that even if the segment of vein fails to become epithelialized a permanent urethra can be formed. In his case he thinks that absorption eventually took place.

Another successful case of this kind has been reported by Remete.¹ His patient had an impermeable stricture. The callus was excised and a piece of saphenous vein 8 cm. long was implanted between the ends of the divided urethra.

Impacted Urethral Calculus. Impacted calculus in the urethra is an apparently rare condition, producing inflammation, edema and proliferation of the adjacent tissue, which locks the stone in place and renders its dislodgment impossible except by mechanical manipulations which must be promptly resorted to in order to prevent obstructions to the urinary flow.

In a recent paper P. A. Jacobs² describes a technic which he has found very satisfactory, inasmuch as it does not traumatize the urethra. Fifteen or twenty olive-tipped whalebone bougies are inserted into the urethra up to the point of obstruction and are manipulated one by one until they are made to pass a little beyond the stone and to surround it, when they are all grasped together and pulled out. The lumen of the bougies is practically obliterated at the olive-tipped end and when they are pulled out the calculus is caught as if in a cradle, the bougies acting as a covering to the rough surface and thus preventing injury to the mucosa during withdrawal. A case in which the stone was successfully removed by this method with practically no discomfort and only trifling bleeding is reported.

MISCELLANEOUS.

Venereal Granuloma. In *PROGRESSIVE MEDICINE* for 1917 this form of venereal disease, at that time supposed to be confined to tropical countries, was discussed, special attention having been given to the investigations made in Brazil by Aragao and Vianna and Desouza

¹ Wien. Klin. Wchnschr., September 22, 1921.

² Journal of the American Medical Association, September 10, 1921.

Araujo. During the five years which have elapsed since the review of this subject a number of cases have been reported in the United States, many of them occurring in patients who had never been in the Tropics. Thus, in 1920, Symmers and Frost¹ reported 2 cases from their service in Bellevue Hospital, New York, and, in 1921, Campbell² recorded 3 other cases from the same institution. Last year, also, Reed and Wolfe³ reported cases which they observed in New Orleans.

Parounagian and Goodman⁴ have recorded the following interesting case in which remote regions of the body were involved:

A man, white, an American, aged thirty-two years, presented a mass of hypertrophic, foul smelling, discharging, red papules and nodules, involving the region of the groins, extending across the pubes downward along the femoro-scrotal clefts, circumscribing the anus, and invading the depression between the buttocks and the legs. In the last mentioned region the clinical appearance was identical with that pictured by De Souza Araujo in a South American case. Furthermore, the patient (who had never left New York City) presented similar lesions on the lips and the side of the neck.

The authors could find only one similar case recorded in the literature.

In a later paper, Goodman⁵ describes a number of other cases of venereal granuloma which he has seen in New York.

At the January, 1921, meeting of the Philadelphia Genito-Urinary Society, Alexander Randall presented a number of patients from the venereal wards of the Philadelphia Hospital, who showed lesions resembling in all respects those described as inguinal granuloma. Injections of antimony given to some of these patients had produced epithelialization of the lesions. Randall stated at that time that his interest was aroused by the publication of Symmers and Frost's paper and that he began the study of a class of cases presenting similar lesions which is always to be found in the Philadelphia Hospital. In a recent article published in conjunction with Small and Belk, Randall⁶ presents an exhaustive study of his cases. He states that in his mind there is no doubt but what this disease has been endemic in the vicinity of Philadelphia for at least fifty years, and cites evidence to show that it has been present in the wards of the Philadelphia Hospital for fully twenty-five years. About 15 patients affected with such lesions, and almost all of whom are negroes, are admitted to the hospital each year and with 1 exception all of the cases which these authors studied were in negroes. In all of these cases, but that of the white man, rapid and apparently complete cure was obtained by the antimonial injections. There were 2 recurrences, both of which, however, were attributed to neglect of treatment. Both patients entered the hospital the second time and were cured as the result of further treatment. It is stated that no alarming symptoms followed the injections of

¹ Journal of the American Medical Association, 1920, vol. 74.

² Ibid, 1921, vol. 76.

³ New Orleans Medical and Surgical Journal, 1921, vol. 74.

⁴ Archives of Dermatology and Syphilis, May, 1922.

⁵ Journal of the American Medical Association, September 2, 1922.

⁶ Surgery, Gynecology and Obstetrics, June, 1922.

antimony and that no changes in the blood or urine could be detected after its use. Three patients who were emaciated and anemic gained in weight and showed an increase in hemoglobin after their local lesions had improved. At first treatments were given daily, an injection of 0.04 being administered until symptoms of intolerance were manifested, which, as a rule, occurred about the tenth day. Then the injections were given at intervals. Often it was possible to give one every second day. The symptoms of intolerance consisted of pains in the joints and stiffness in the muscles, and were most noticeable early in the morning. Tartar emetic was the drug used in the majority of cases, but a synthetic antimonial compound, sodium-antimony-thio-glycollate, prepared by Abel, of the Pharmaceutical Department of the Johns Hopkins Medical School, was used with brilliant results in 1 case. The highest dosage of tartar emetic required to bring about complete healing was in a female patient, who had thirty-two injections, equivalent to 1.96 gm. One patient, having a lesion the size of a silver quarter, was cured by four injections. It is stated that healing commences within forty-eight hours after the first injection, and that daily progress can be noted as the treatment is continued. Epithelial proliferation starts at the edges and rapidly spreads inward, while often isolated islets of epithelium in the midst of granuloma start proliferation in the center of the lesion. The typical encapsulated organism could not be demonstrated in smears taken after the second or third dose of antimony. Following the advice of Vianna, who introduced the antimony treatment of venereal granuloma, the authors have endeavored to get all their patients to take at least twelve injections. If the sores heal before twelve have been taken, they continue to give one each week until the full number have been administered.

Organisms corresponding to those described by Donavan, Aragao and Vianna, and others, were demonstrated in 12 cases. In the other 4 of the series no laboratory examinations were made. The organism is a Gram-negative encapsulated bacillus, which the authors believe does not possess sufficiently distinctive characteristics to warrant its separation from other members of the group; and they quote Aragao and Vianna, who formerly believed that they had isolated a specific bacillus, which they named *calymmato-bacterium granulomatosis*, to the effect that further studies have left them doubtful as to whether a new and specific member of the group can be established.

In 3 cases Randall and his associates were able to grow cultures of an encapsulated bacillus obtained from the lesions. They also conducted some experiments upon animals. It was found that lesions produced by the strains of granuloma origin, and those produced by different members of the group were identical. Intraperitoneal inoculations of mice and guinea-pigs proved rapidly fatal, but cutaneous inoculations failed to produce any lesions. The subcutaneous inoculation of rabbits resulted in the formation of abscesses which ruptured spontaneously and left ulcers which healed spontaneously in from three to seven weeks. Their gross appearance did not resemble

granuloma, although histologic examination of their walls showed tissue which could not be differentiated from that of typical granulomata in man.

The authors describe the lesions as follows: The typical lesion is a flesh-red exuberant overgrowth of soft granulation tissue, having absolutely no similarity to an ulcer. Its center appears slightly depressed, but the edges overlap the apparently healthy skin margin. Exudate is scant, mucoid in character, of a nonoffensive odor, and when wiped with gauze is easily removed, leaving a clean, blood-red surface similar in every respect to a large area of healthy granulation tissue as seen in clean surgical wounds. The later lesions may show tendencies toward healing at some points, while spreading in others, but this occurs only when flat nonchafing surfaces are involved. The most frequent location is in the groin, extension taking place as far backward as the anterior-superior spine of the ilium and downward through the fold of the groin to the perineum, whence it may work its way backward and upward to the buttocks. In the female the labia majora are most frequently involved. Extension may take place the same as in the male. The granuloma is practically painless. Secondary anemia is present in cases of long duration, and loss of weight has also been noted. The authors have had 4 cases in males in which the lesion was limited to the groin, 2 with penile involvement, 1 limited to the anal region, and the remainder with multiple involvement, including the perineum.

Value of Drugs in Urology. In this article Hugh H. Young¹ publishes an analysis of the answers to a questionnaire which he sent to thirty well-known urologists concerning seventy drugs that are recommended in the treatment of genito-urinary diseases. It was requested that they indicate only those drugs which they had found useful in their practice. Only 18 out of the list of 70 were approved by 50 per cent of the urologists; 30 per cent gave approval of 25 of the drugs. Hexamethylenamin stood first in the list, and silver nitrate second. Potassium permanganate was given the third place and argyrol the fourth. Young makes the comment that silver nitrate is indispensable and that permanganate and argyrol, while known to have very weak antiseptic properties, are non-irritating. It might well be added that permanganate is also cleansing, in that it decomposes secretions and produces a slight serous outflow. It is remarked that the rest of the total list of drugs bore silent testimony to the fact that the urologist is not a polypharmacist and many widely heralded and much-advertised preparations have not proved acceptable.

¹ Journal of the American Medical Association, October 22, 1921.

SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES, DISLOCATIONS AND TUMORS.

By WALTER ESTELL LEE, M.D.

THE present practice of surgery has not escaped the universal distrust of things social, economic and politic. Bernard Shaw,¹ in an address to a meeting of medical men, protesting against the knighting of Mr. Parker (the bone-setter), calls attention, in his usual paradoxical vein, to the "advantages of being unregistered," or, as we would say, unlicensed.

"This title was usually given in medicine to the heads of the profession. Here it had been bestowed on a man who was not only unregistered but unqualified. He had no recognized medical training but 'had learned his business' from another bone-setter. The faculty was inclined to regard such persons as ignorant. Unfortunately, they got relatively as many cures as the qualified, and often obtained their best results when the latter had failed. *To the public there had always been a glamor about the unqualified man—probably because he dared to charge more than his qualified rival.* His popularity had increased so much of late that patients would now frequently run the whole gamut of osteopaths, masseurs, Christian scientists and psychotherapists before turning to the qualified physician."

What was the cause of this waning faith? He attributed it to the narrowmindedness of the general medical council. Its main failing was that it consisted entirely of physicians. Such a system tended to a medical autocracy, and the community, for whom the physicians worked, had no opportunity of expressing its views on medical organization and conduct. The remedy lay in constituting the council mainly of members of the informed public, with physicians as assessors. Such a body would be in a position to effect several needed reforms in medical practice and education. First was the question of admission to the profession. It was absurd for any body of men, whether physicians or bottle-washers, to say to a man, "You shall not enter our profession." That was for the general public to say. Next came the problem of medical education. The most needed reform was lengthening of the curriculum, but this could be compensated for by cutting out certain unnecessary parts of subjects which were taught at present. The smattering of science, for instance, in which the medical student was grounded, was unnecessary. Medicine was not a scientific profession. Yet such was the effect of the so-called scientific training that

¹ Journal of the American Medical Association, August 12, 1922, p. 572.

the surgeon tended to regard all disease problems as mechanical, the physician to regard them as chemical; whereas, such problems were vital.

Perhaps this is not all true, but it is right in that the real trouble lies not with the public but in the profession itself. The time has long passed when we can complacently say this lack of confidence is entirely due to the inability of the patient to appreciate our methods and ourselves. It is time for us to "stop, look and listen," as the railway signs have it at dangerous crossing, and not at the distrusting public but at ourselves. A young woman, under thirty years, who was recently referred from one of the smaller community hospitals, now so common in our country, will serve as an example (we will admit an extreme one) of the cause of the public's distrust. After a cholecystectomy and appendectomy, a bilateral salpingo-oöphorectomy, a myomectomy and finally a hysterectomy (all separate operations) the patient was sent to the hospital with the request that we anchor her movable kidneys because she was unrelieved of her symptoms.

Tarnowsky¹ indulges in a very useful introspective study which he calls "the fad for pseudoscience."

Blind indeed must be the present-day Æsculapian who does not sense the changing attitude of many laymen toward our profession. With all due allowance made for the endemic reform wave, the competition of pathies and isms, the desire for "something new" and the unmistakable tendency toward compulsory state health insurance, the fact remains that our patients are demanding that they be more fully taken into consideration as individuals and not as cases, and that they be subjected to lines of treatment based on natural laws. Equally blind is the doctor—specialist or general practitioner—who, frankly comparing notes with his colleagues, has not sensed a faint, but nevertheless unmistakable, awakening to a fuller realization of the truth as at present understood, based on rational knowledge of the basic subjects of our medical studies.

Why is there so much medical unrest, so much open or hidden dissatisfaction among an ever-increasing percentage of the medical profession? It is still fashionable to blame the World War for everything; certain it is that many of our fellows returned from camp or overseas to their more or less thoroughly disrupted civil practices with new ideas, new thoughts and many doubts regarding the value of certain surgical or medical "sheet-anchors," to which they had clung through the years as barnacles to a ship's bottom—barnacles being periodically scraped off whenever a vessel is dry-docked for repairs. Never in the past quarter of a century has there been such dire need of medical dry-docking as at present.

May all this mental doubt not be due to the fact that the medical "Intelligentsia," to use a new popular term, has come to realize that it knows too much and too little of the forces which preside over the state of balance which we call health and of the biochemical changes

¹ Journal of the American Medical Association, vol. 76, 859.

which occur in departures from the normal? Happy indeed is the physician who can still prescribe tincture of ferric chloride in erysipelas, or apply a beautifully finished and carefully dated plaster-of-Paris cast over a non-reduced fracture with a clear conscience; thrice happy and to be envied is the still more venerable practitioner who has definite specifics which can, in the twinkling of an eye, "scatter" inflammation internally or externally.

Methods of treatment have ever changed with—not ahead of—the evolution of knowledge; but, whereas in the past the individual's gastro-intestinal tract could rebel and eject the offending potion *per vias naturales*—either proximal or distal—Nature is now given no chance of asserting itself because we either plunge our medication intramuscularly, intravenously or intrathecally, or else apply emanations whose potentiality for harm, when injudiciously used, is rarely mentioned in scientific discussion.

Are there no voices in the wilderness sending out a warning cry which will cause the thoughtless among us to pause and think before accepting new curios and applying them to the alleviation of disease? Yes, thank Heaven, a few courageous physicians have recently made themselves heard in no uncertain tones. Read Harvey Cushing's presidential address, delivered before the Society for the Study of Endocrinology.

In a recent number (April, 1921) of the *Anales de la Facultad de Medicina of Lima*, Peru, is the bold statement made by Escomel to his students:

Each individual exhibits idiosyncrasies or special predispositions to immunity or anaphylaxis; in his own blood-stream are marshalled the forces of reaction, and it follows therefore that his serum contains all of the biochemical elements, either in process of transformation or reaction, with which he will defend himself against bacterial invasion regardless of the latter's species, strain or morphology. It is, therefore, self-evident that each individual harbors a polyvalent serum, which belongs to him exclusively and which is capable of exerting the maximum of benefit or of curative value on himself alone. Is this not tantamount to the frank admission that departures from the normal, *i. e.*, diseases, tend to be overcome by means of a total, integral auto-genous serum? Even granting that a very few so-called specific antitoxins, such as those of diphtheria or of tetanus, have proved their prophylactic or curative value, there are valid objections against the use of serums obtained from zoölogical species which differ more or less widely from man; is it not reasonable to ascribe to this fact the majority—if not all—of the hemolytic and anaphylactic phenomena which have sometimes even terminated fatally? Does not the use of a heterogeneous antitoxin explain the not infrequent failures which in all probability always occur in polymicrobial infections?

With equal truth, Escomel might have added that the polyvalent commercial antitoxins represent a thoroughly inaccurate and unscientific attempt to meet this polymicrobial type of infection. Inaccurate because the individual's bacterial flora are rarely, if ever, cultivated

and identified prior to the use of these "shotgun" infections; unscientific because, even if such cultures were made, they could not accurately indicate the relative present toxicity of the various strains in the individual and hence determine the percentage of each and every "specific" antitoxin which the manufacturer so glibly puts up and markets for the convenience of our inert gray matter. Is not Pierre Duval's recent attempt to treat appendiceal infections by means of polyvalent stock vaccines which include all "probable" bacterial strains—from *Streptococcus hemolyticus* to the colon bacillus, with *Bacillus catarrhalis* and a few other varieties thrown in for good measure—a distinctly retrograde one, scientifically speaking? Finally, are there not grave doubts in the minds of many thoughtful men, internists as well as surgeons, that antitoxin reactions are merely non-specific protein reactions? Is not the present wave of "milk-serum" injections a tacit admission of the truthfulness of the foregoing suspicion?

The craze for novelty, love of the pseudomiraculous and fear of not finding himself "in the procession" are prompting too many of our colleagues to discard methods of treatment which have stood the test of time for pseudoscientific measures which appeal to the imagination or inherent love of mysticism of our patients; and we, the conservatives, are called on to repair the often irreparable damage done by the faddists.

How can we teachers protect the present and future graduates in medicine from these fatal tendencies? Can we not more strongly impress on them the reliability of basic principles of anatomy, physiology and biology, and the unreliability of commercialized read-to-use methods which are surely undermining our standing in the body social? Are we sufficiently emphasizing the curative forces of Nature in our lectures or demonstrations—whether they be on general or special topics of the healing art? Is it not the duty of teachers—either in the fundamentals or in the specialties—to tell our students what Nature, unaided, will do or try to do in any given departure from the normal in order that they may learn to avoid antagonizing the forces of Nature, which we are at last beginning to understand and appreciate at their true value? Is it not time for us to clean house, to teach our students along rational lines, discarding the many fetishes we have so long clung to and cautioning them against new theories until the latter have become facts? Both in surgery and in internal medicine we have often failed to give Nature full play, and *the undoubted success of the host of pathies and pseudoreligious sects with which we are waging a more or less futile and undignified warfare is the natural reaction against our stubbornness.*

Will not our position in the body-social be strengthened rather than weakened when we drop the mantle of mystery with which we at present surround ourselves and frankly take the public into our confidence? The time will never arrive when Nature cannot be helped in a myriad of logical ways and medical men will ever be in demand; *the trouble with our profession is that it persists in too much meddlesome therapy—using the term in its broadest sense—to the detriment of Nature.* We are

losing sight of "the patient himself" - to quote from Hugh T. Patrick's superb article on the subject - and many of us are substituting machine-made diagnoses for clinical acumen, read-to-use advertised remedies for intelligent coöperation with Nature, fads for facts.

Let's drydock!

Medical Education. We would suggest that a faulty system of medical education in the past and present makes such conditions possible and that any hope for a change lies in a reorganization of medical education.

de Schweinitz,¹ in his presidential address before the American Medical Association discusses these necessary changes at length.

Medical education, omitting from consideration premedical instruction, naturally divides itself into: (a) Undergraduate or pregraduate education; (b) graduate or postgraduate education; and (c) university extension education, that is, community service.

1. *Pregraduate Education.* The standards have been raised to an acceptable height, and a curriculum suggested after conscientious and sometimes meticulous study and thought. But emanating from educators and from the student body there is a justifiable and well-known criticism, expressed almost epigrammatically by one of them, unusually well balanced and among the favored ten: "We get our instruction in packets. The students never realized, or more properly, were never made to realize," he proceeded, "the proper relation, for example, of anatomy and physiology to the general scheme, until the 'clinical year' arrived, and by that time the packet had grown old and musty."

As has been clearly stated by Henry S. Pritchett, "These fundamental sciences should be taught, not as something separate from medical practice, but as part of it. The fiction that the medical student can be prepared for medical practice by learning a mere fragment from every field of science ought to be definitely given up." Moreover, it is evident, as has often been pointed out, that instruction in these fundamentals—physiology, anatomy and pathology—is too widely, perhaps too strictly, separated from clinical training, which should be introduced into the curriculum at a time sufficiently early to make it the important medium through which the student shall acquire a familiarity with the practical application of these subjects. These should keep pace with the other branches of the tree of knowledge, being neither lopped off nor allowed to wither.

In short, looking at this matter from any standpoint, if the student is to be properly fed educationally, he must have a much more evenly balanced diet, and, in the words of a great educator, "Reform of the curriculum of the undergraduate medical school is one of the most pressing questions of present-day medical teaching."

2. *Graduate Teaching.* That even today, except in limited supply, opportunities for graduate instruction, greatly needed and eagerly sought, are not commensurate with the rank they deserve and require, is a matter of common knowledge and of regret. To be sure, for many

¹ Journal of the American Medical Association, 1921, 78, 1583.

years postgraduate courses have been available, and some of them have been conducted, especially those which pertain to the "specialties," on a high plane and have achieved good results; but, in the main, it must be admitted that they have been unsatisfactory. Indeed, only too frequently men have been certified as qualified along certain lines of medical and surgical practice after inadequate instruction, and they have been stamped, as it were, with approval unjustified in the circumstances.

Time does not permit an analysis of the types of graduate medical courses which are, and have been, in operation. We are all well acquainted with the methods (as summarized by Meeker) of obtaining graduate educational equipment through the medium of clinical and laboratory assistantships, of personal courses, of attendance on clinics recommended from a central registration office (London type) of short "polyclinic courses" (too often imperfect and superficial), of brief organized university courses (somewhat similar to the polyclinic courses, but with the advantages of university surroundings), and of assistantships under university and foundation control. None of these plans, despite certain excellent qualities which pertain to most of them, meets the requirements of graduate instruction as it should be considered at the present time, in the sense of taking place in a school of graduate medical education, and, moreover, in one in coöperative affiliation with an undergraduate medical school, and preferably with one which is a department of medicine in association with a university.

In the last-named circumstances the graduate school of medicine becomes part of a university system, as Meeker has said, and should be so organized that it can take advantage of all other available or required medical and scientific instruction, hospital or laboratory and industrial plants. Under such conditions a truly comprehensive plan of graduate medical education is possible, founded on the best types of courses, correlated with the facilities which have been named, and leading to a certificate or suitable degree. That such a plan is not "too comprehensive" and can be carried out with gradually increasing satisfaction to those concerned, is evident from the fact that at least in one university it is in full and satisfying operation and has made a contribution of the highest value to medical education. There is no reason why, in the near future, similar methods of graduate school education should not be active in all our larger medical centers. No appeal can be too urgent for sympathetic, moral and financial support for such a type of graduate medical education.

3. *Medical Extension Education.* In recent times a rather widespread disquietude has arisen lest the supply of doctors should become inadequate. From the numerical standpoint, as a recent investigation has shown, this fear may be dismissed. But the geographic distribution of physicians is a problem that may well excite concern. It would seem that the rural districts, villages and smaller towns are being drained, on the one hand, and, on the other, are failing to receive their just quota of the graduates in medicine, owing to the attractions and greater facilities—laboratory and hospital—of the larger towns and

cities, from which the physician with a modern training not unnaturally declines to be separated. Also, poor economic conditions add their deterrent influence.

The recent graduate stationed in the country, lest he suffer a disastrous eclipse, must keep in practical touch with new developments in diagnosis and treatment, and, moreover, his patients are insistent that he shall do so. He cannot leave his duties to seek such information and instruction in distant "centers;" hence methods are being devised whereby such facilities shall be brought to him in an endeavor to satisfy the practitioner's laudable ambition and his requirements, as well as the desires of his clientele.

In some of our states, South and West, and also recently in the East, annual courses have been organized, conducted through their respective university extension services, in coöperation with the county societies alone, or with these societies aided in certain respects by the state boards of health. Primarily it should be ascertained in which districts such courses are desired. Information in this respect may well be secured by the committees on scientific work of the state societies, as, indeed, in certain commonwealths it has been and the courses suggested after consultation with the local or county society, and their membership because it is from them that the invitation comes.

Reference has been made to graduate medical courses based on university-extension services, as they are already in operation, notably in one state. Therefore, when a university system includes a school of graduate medicine it can carry its educational efforts to groups of physicians found in selected localities. Such endeavors have as yet not attained their full development, and for the most part, at least, are in their formative stage. A comprehensive program with respect to this type of education is being studied, on request, by the dean of the Graduate School of Medicine of the University of Pennsylvania and a committee appointed by the state medical society.

Anthrax. An editorial in the *Journal of the American Medical Association*, 1922, 79, 43, calls attention to anthrax in man as a disease of such serious moment that its menace scarcely needs to be emphasized. The more recent outbreaks of cases attributable to infection from shaving brushes have tended to arouse a greater interest in the subject and to awaken public health officials in many places from the apparent lethargy in regard to it. Anthrax in man is most frequently encountered among workers on hides, hair, bristles, wool, etc., and in laboratory workers, veterinarians, meat inspectors, farmers, cattlemen and butchers.

In Pennsylvania, according to the investigations of Smyth and Bricker,¹ slightly more than 8 per cent of the 7458 men engaged in 57 cattle-hide tanneries were directly exposed to anthrax risk during the period under consideration. In 19 goat-skin tanneries, employing nearly 6000 men, somewhat more than 7 per cent were directly exposed. Thus, a total exceeding 1000 men, or not quite 8 per

¹ Analysis of One Hundred and Twenty-three Cases of Anthrax in the Pennsylvania Leather Industry, *Jour. Indust Hyg.*, June, 1922, 4, 53.

cent of the employees, was exposed to the serious danger. Of these, at least 119 contracted anthrax in the course of the twelve years included in the Pennsylvania study, and 4 more cases developed in those handling raw hides or skins, making 123 cases in all, or more than 11 per cent of the number of directly exposed tanners. Seventy-three of these cases were due to the handling of cattle hides, and 50 to the handling of goat skins. One-fifth of the patients died.

This is not the place to discuss the comparative danger of hides from different sources. The fact that during a five-year period a yearly morbidity-rate is on record of almost 2 per cent from anthrax among directly exposed tannery employees suffices to point to the lesson. Hides and skins imported into this country are supposed to come in under quarantine unless accompanied by a consular certificate stating that they are from a district free from anthrax. But the experience of Smyth and Bricker agrees with that of others to the effect that this certification is worse than useless, since it merely establishes a false sense of security among the tanners and freight handlers. It is stated that anthrax has been contracted from the handling of both dry and wet salted hides and skins, and from both certified and uncertified stock, and anthrax bacilli have been isolated from both. It is high time to give more serious consideration to the anthrax problem. The tanneries must no longer be allowed to receive anthrax-infested raw stock.

Symmers¹ holds that the experience of recent years indicates that we must relinquish certain conceptions that have been bequeathed to us concerning the therapy of anthrax in man. It is now known that the pustule of cutaneous anthrax frequently heals spontaneously if it is left to its own devices and not subjected to operation or cauterization, either of which may precipitate septicemia. Anthrax septicemia, on the other hand, is commonly regarded as a form of infection that is practically always fatal. As a matter of fact, of all the septicemic diseases, it is the one with which we are best prepared to deal, namely, through the use of immune serum. The literature of medicine contains references to 6 cases of cutaneous anthrax with bacteriologic proof of disseminated infection, in which recovery followed the intravenous use of antianthrax serum. A seventh is described in this paper. The same method of treatment would appear to be applicable to the septicemic forms of pulmonary and intestinal anthrax, although Symmers has not been able to find any reference to its employment in such cases.

The localized cutaneous lesion of anthrax, when fully developed, presents an appearance scarcely to be mistaken for that of any other disease. It is an ugly affair to look upon, painless and possessed of vicious potentialities. It is characterized by a dirty brownish eschar, scattered over and surrounding which are numbers of pinhead-sized silvery vesicles, the whole set in the midst of an area of swelling which may remain within moderate bounds or assume such enormous proportions that when the pustule is situated on the face or neck the eyelids are closed and the tissues of the upper part of the chest are thrown

¹ *Annals of Surgery*, July, 1922, No. 6, vol. 75.

into large edematous folds. The swelling is due to the presence of a semigelatinous substance—anthraco-mucin—which is inimical to the growth of the anthrax bacillus and which represents a defense reaction on the part of the tissues and should be left alone.

While the anthrax pustule itself offers a forbidding aspect, the appearance of the patient, on the contrary, is apt to give one the impression of extraordinary tranquillity, even though his blood may be swarming with anthrax bacilli. For this reason, the only really justifiable attitude for the physician to assume is that every anthrax pustule from the outset is attended by the dissemination of bacilli in the blood, and to treat the patient on this assumption until the result of the blood culture is known. It is, at best, an error on the safe side. In artificial culture media the anthrax bacillus grow with facility and positive cultures may be sometimes secured within twelve hours, always within twenty-four hours. A negative result in twelve hours should never be accepted; a negative result in twenty-four hours need never be rejected. In the meanwhile the administration of serum is a harmless procedure, and, in the event that anthrax septicemia exists, valuable time will have been saved.

1. Every anthrax lesion of the skin or elsewhere should be tentatively regarded as attended by generalized infection until the result of the blood culture proves the contrary.

2. In no circumstances is it justifiable to tamper with the anthrax pustule—incision, excision, cauterization or similar treatment is dangerous, and may be followed by anthrax septicemia. The only permissible form of local treatment consists in the injection at the periphery of the pustule of broken doses of antianthrax serum at intervals of four or six hours, each injection not to exceed a total of 10 or 15 cc. Failing this, it is better to cover the lesion with a bit of sterile gauze to collect the secretions, but otherwise to leave it absolutely alone.

3. The most dependable routine method in the treatment of the anthrax pustule is: (1) To isolate it within a barrier of antianthrax serum subcutaneously injected every four hours; (2) to inject intravenously, at once, a sterilizing dose of 150 or 200 cc of serum; and (3) to supplement this by the intravenous injection of 40 cc every four or eight hours. If the blood culture is negative at the end of twenty-four hours the intravenous use of serum may be discontinued, the local injections being kept up until the pustule is free from bacilli, or at least until involution forms occur in the stained films. In anthrax septicemia the liberal use of antianthrax serum intravenously, if commenced in time, is capable in many instances of sterilizing the blood with astonishing rapidity, and in septicemic cases the routine just outlined may be followed until the blood cultures are negative.

Regan¹ reports 8 cases of anthrax successfully treated in the last two years with Eichhorn antianthrax serum, given by local injection around the lesion and general injection into the circulation, without any fatalities. The acute inflammation disappeared from the second

¹ Journal of the American Medical Association, December 17, 1921, p. 1944.

to the sixth day of treatment, the eschar separated from the twelfth to the twenty-first day, and the wound healed from the twentieth to the thirty-second day. No sequelæ were noted in any instance, and the scar left was so minute as to pass unnoticed. The acute stage was over within a week.

SEROTHERAPY OF ANTHRAX. Biancheri¹ protests against incision of the focus as intramuscular or subcutaneous injection of the antiserum has always proved effectual in his experience, unless the patient was moribund when first seen. He injects 60 cc at first, and then 20 cc each day. After the local inflammation has entirely subsided, he excises the eschar to hasten the healing. Conti, on the other hand, excises the lesion completely with a deep circular incision. The mortality was 3.33 per cent in 60 cases treated in this way, while it was 20 per cent in 20 treated by a crucial incision.

Human Actinomycosis. Although the disease "lumpy jaw" in cattle was first described by LeBlanc in 1826, it was not until 1877 that Bollinger and Hartz discovered the specific microorganism and gave to it the name actinomycosis bovis. Israel and Wolff shortly afterward isolated the same organism in pus of an empyema in the human subject. Since the discovery of Wolff and Israel, there have been many and varied human manifestations of this disease reported in the literature. This is especially true for the past decade due in a large measure to the fact that many of the earlier cases went undiagnosed, though some investigators believe that this disease is gradually becoming more prevalent in this country.

Mattson² has studied 44 cases at the Mayo Clinic. Vander Veer³ reports 1 case.

There is but one true species of microorganism capable of producing actinomycosis in man and lower animals, and this is the one isolated by Wolff and Israel, and later more fully described by Wright.

There is no convincing clinical evidence supporting the theory that this organism is a normal inhabitant of the oral cavity and gastrointestinal tract of man.

There is much clinical and biologic evidence that this microorganism has its source outside of the human body and is capable of a dual existence: first, as a saprophyte in old sod soil from which it gains access to grains and grasses, and through this medium or intermediary host, so to speak, it becomes capable of infecting man and lower animals.

In order for infection to take place, two things are necessary: (1) An abrasion of the tissues; (2) the fungus must in some way be brought directly in contact with this abrasion.

Animal-to-man infection is far more common than we have been led to believe it was by earlier investigators.

Human actinomycosis is not a rare disease, but a disease which is often overlooked or incorrectly diagnosed.

Every inflammatory swelling of chronic or subacute nature with

¹ Policlinico, Rome, May 29, 1922, Nos. 22 and 29.

² Surgery, Gynecology and Obstetrics, 1922, **34**, 482.

³ Medical Record, February 18, 1922.

persistent and recurring sinus formation should be carefully investigated for this disease.

A negative smear, on first examination does not rule out infection as the fungus, in the presence of mixed infection, is often very difficult to find.

The disease should always be kept in mind in every case of atypical pulmonary tuberculosis and should be looked for in cases suffering with chronic purulent bronchitis or bronchiectasis.

PROGNOSIS. In neck and jaw cases the prognosis is good. Of the 14 cervical and 7 jaw cases in this series, 12 reported themselves as entirely cured; 7 were improving, but not entirely well. Skin cases, while stubborn, eventually clear up under vigorous treatment. The mortality in appendiceal cases was 100 per cent, all having died after being under treatment for six months to a year. The pulmonary form in this series was just as fatal as the appendiceal, aside from the rare case of bronchial infection, which was still living twenty years after infection took place, though the patient was much annoyed by a chronic purulent bronchitis.

TREATMENT. This seems to be one disease in which potassium iodide is specific. Heroic doses, however, are necessary, as even moderate doses do not produce results. The initial dose should not be less than 75 drops of the saturated solution, three times daily, well diluted. This may be increased 1 drop daily until a maximum of 125 or 150 drops, three times daily, is reached. If symptoms of iodism intervene, stop the drug for three or four days and then resume at the same dosage taken when the drug was discontinued. By this method cases have taken as high as 150 drops three times a day eventually, with excellent results and no untoward symptoms.

Surgery is of value only where the tissue involved can be widely excised. The involved tissue was widely excised and the wound packed with iodinated gauze and kept open, with the hope of combating the anaërobic tendency of the parasite. While the surgical treatment no doubt hastened the cure in most cases, he does not believe it essential except where softening and abscess formation has taken place. The hard, inflammatory nodules before the stage of softening has been reached respond very well to potassium iodide alone as a rule.

Mycetoma. Kirkham¹ claims that mycetoma, though known and described by ancient Indian writers, has been considered quite rare and looked upon as essentially a disease of India. It is possible that it is not as rare as has been supposed, especially in Tropical and semi-Tropical countries. Probably many cases of mycetoma have been incorrectly diagnosed elephantiasis, and *vice versa*. But since we have learned more of its pathology, this should not occur.

It was first described as a distinct disease in Bret's *Surgery* in 1840; but many early writers considered the disease as tuberculous. Its parasitic nature was first suggested by Ballingall, in 1855, but it was not until 1874 that V. Carter found the causal organism. Cultural

¹ Surgery, Gynecology and Obstetrics, 1922, No. 6, 34, 686.

methods at this time were crude, and though cases were reported by Bassini in Italy, in 1888, by Vincent in Algeria, in 1894, and the first case in Canada by Adami and Kirkpatrick, in 1895, many of these were regarded as identical with actinomycosis, and it was not until 1906 that Brumpt published a paper showing that actinomycosis was a separate and distinct disease from the other varieties of mycetoma which are caused by separate varieties of fungi.

This disease is distributed throughout the world; but, due to its prevalence in India, it has always been regarded more or less as a disease peculiar to that country. From the number of cases reported from the different parts of the world, and especially from the Southern States and Central America, it is very probably that its incidence is of far greater frequency than is generally supposed; and it is also probable that many cases are incorrectly diagnosed as actinomycosis.

ETIOLOGY. Most commonly we have a history of some injury, sometimes insignificant, which allows the fungus to enter the subcutaneous tissues. The disease is most commonly seen in the foot, hence its name, Madura foot; occasionally it is seen in the hand and rarely in other regions.

There are two main types of the disease dependent on the color of the granules which can be expressed from the lesions, namely, white and black. However, there are many strains of mycetes which have been classed as causative. The following classification with the date and name of its discoverer, is perhaps the most complete.

	Germ.	Species.
Ascomycetes	Aspergillus	A. Nidularis (Eidam) 1883.
	Ospora	A. Bouffard's (Baumpt) 1906. O. Tozeuri (Nicolle and Pinoy), 1907.
Hyphomycetes	Discomycetes	D. Bovis (Harz), 1897. D. Maduræ (Vincent) 1894. D. Asteroides (Eppinger) 1890.
	Madurella	M. Mycetomi (Laveran) 1902.
	Indiella	I. Mansoni (Brumpt) 1906. I. Reynieri (Bumpt) 1906. I. Somaliensis (Bumpt) 1906.

With the exception that the *discomyces bovis* lives in spikelets of various cereals, little is known of the saprophytic life of these fungi. It is most common in the barefoot races in the poorer class and in males.

PATHOLOGY. Essentially this disease is a hyaline degeneration and necrosis which attacks all tissues, even at times with giant and epithelioid cells and little attempt on the part of the body at reaction.

SYMPTOMATOLOGY. The disease usually begins in the foot following an injury often insignificant; but sometimes the hand, leg, neck or trunk may be affected.

Soon after the original wound is healed there is swelling and pain in the affected part, with a blackish discoloration of the skin, and the formation of hard lumps, which have a tendency to bleed and show the formation of sinuses which discharge an oily fluid containing the

characteristic granules. In different parts of the foot new nodules appear, and the foot swells until it is ultimately converted into a more or less shapeless mass. The patient frequently complains of a sensation of foreign body in the foot. In most cases the dorsum of the foot seems more affected than the plantar aspect. Practically no effect is noticed upon the system in general. The condition often lasts for years, or until the part becomes so swollen that the patient is incapacitated for walking.

DIAGNOSIS. The diagnosis is based on the peculiar swelling of the foot, with the formation of sinuses which discharge the characteristic sclerotia. The diagnosis is confirmed by isolating the fungus which can be grown on ordinary media, and is a facultative aërobe. On glycerinated agar it forms discoid colonies, white in the center and reddish at the periphery. The mycelian threads and spherical bodies are Gram-positive, but not acid-fast. It must be differentiated from tuberculous disease of the foot, actinomycosis and elephantiasis.

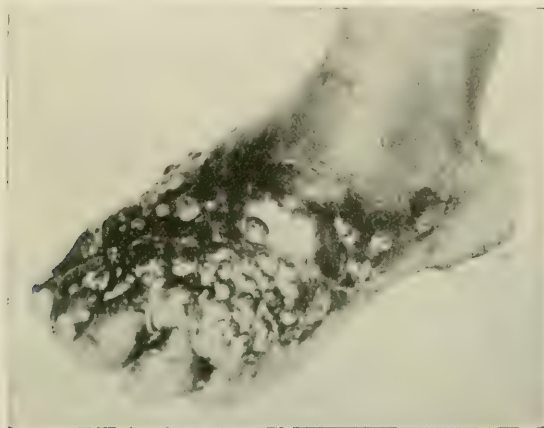


FIG. 5.—Patient's foot before removal. (Kirkman.)

PROGNOSIS. The disease is incurable unless treated surgically.

TREATMENT. In well-marked cases amputation affords the only hope of relief. Unlike actinomycosis, potassium iodide, in even large doses, has no effect (Fig. 5).

Two more cases are reported from Texas by Pagenstecher.¹ These 2 cases are characteristic of typical Madura foot, or mycetoma. The history of the injury is clear in each instance, both patients being laborers and forced to make their living by manual means, closely associated with the soil, going barefooted a great deal while at work (Figs. 6 and 7).

Tetanus. A correspondent of the *Journal of the American Medical Association* reports that in the General Hospital, of Madrid, there have occurred, during the last year, among the operative cases, 9 deaths.

¹ *Journal of the American Medical Association*, 1922, No. 18, vol. 78.

As happens in all such cases when the tetanus germs are transmitted by the suture material, catgut, the patients were already convalescent or had been discharged as cured when the tetanic symptoms appeared.

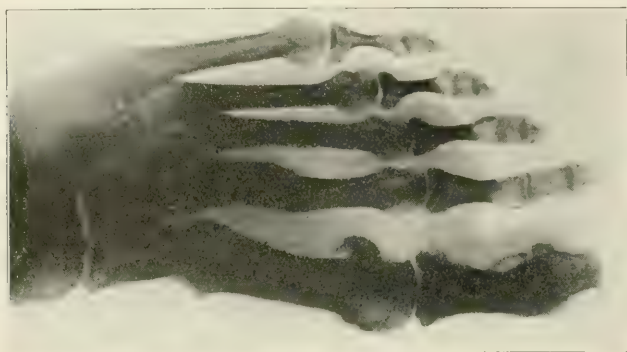


FIG. 6.—Case I. An early stage of rarefactive and productive osteitis confined to the metatarsal and phalangeal bones of the great toe. The metatarsal bone of the second toe presents a healed fracture with clear position and slight excess of callus formation. (Pagenstecher.)

The fact that tetanus occurred in several clinics that had been furnished catgut at about the same date seems to indicate that the germs were inside the catgut.

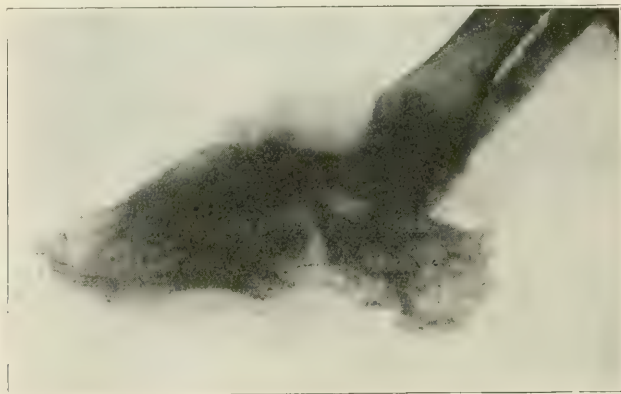


FIG. 7.—Case II. A very late stage of rarefactive and productive osteitis of all the bones of the foot and the distal end of the tibia and fibula. (Pagenstecher.)

Ashhurst's report on tetanus to the International Surgical Society is quoted freely because we feel it is the last word on the subject at this time.

A. PATHOGENESIS OF TETANUS.¹ The following propositions may be accepted as proved. (The evidence on which they are based is

¹ Report V^e Congrès de la Société internationale de Chirurgie, Paris, July 19-23, 1920.

detailed at length in a monograph by Ashhurst and John.¹ All references prior to that date may be found there.)

1. The disease is a pure toxemia; the bacilli or their spores may exist indefinitely in the tissues, and no symptoms will be produced unless toxins are formed.

2. In experimental tetanus, when small animals are used, the form of tetanus ascendens occurs: Here the symptoms of the disease begin in the inoculated extremity and though other neighboring parts may become affected subsequently, yet death or recovery usually occurs before trismus and retraction of the head develop. In the larger animals and in man, however, the symptoms usually begin first in the muscles of the neck and jaws, no matter where the point of inoculation; subsequently the muscles of the back and trunk are affected, and finally the extremities. This form of the disease is known as tetanus descendens.

3. It is a fact that the toxin ascends the peripheral nerves to the spinal cord.

4. The toxin also enters the general circulation, but only when this toxin reaches the spinal cord does it produce characteristic tetanic symptoms.

5. *Causes of the Symptoms of Tetanus.* The toxin stimulates the motor cells of the spinal cord, with the result that the muscles controlled by these cells are thrown into tonic spasm; the toxin also renders the sensory side of the cord extremely susceptible to external stimulus, so that very insignificant stimuli, such as the slamming of a door, jarring the patient's bed, a sudden draught of air, etc., will bring on a clonic convulsion, or at least will greatly intensify, for the moment, the tonic spasms.

B. PROPHYLAXIS OF TETANUS. 1. Certain *classes of wounds*, received in certain surroundings, are more often followed by the development of tetanus than are ordinary wounds. The *Bacillus tetani* normally infests the intestinal tract of horses and cattle (it is found in the intestinal tract of perhaps 5 per cent of mankind) and is deposited with their dung. Therefore, wounds contaminated with barnyard or highly cultivated garden soil, those produced by dragging in street dust, etc., are especially liable to be infected with tetanus bacilli. Gunshot wounds are liable to contamination not *per se*, but only as these conditions, and others, presently to be mentioned, obtain.

Growth of the organisms is favored by anaërobic conditions of the wound. These are present in any wound in which there is tissue destruction, which implies cessation of circulation in the devitalized tissues; the best culture medium for tetanus bacilli is that which contains some dead organic tissue. Contused, lacerated and gunshot wounds offer ideal conditions for the development of any bacilli present; and as the bacilli are carried into the wound only by a missile (shell fragment, fragment of clothing, splinter of wood, rock, etc.) and usually remain attached to the missile, it follows that wounds with retained missiles offer the most favorable conditions possible for the development of tetanus. Punctured wounds are to be dreaded not because

¹ The Rational Treatment of Tetanus, American Journal of the Medical Sciences, 1913, 145, 806; 146, 77.

the vulnerating instrument is retained, which it seldom is, but because it was contaminated either (a) even before it pierced the skin, or (b) because it carried infection from the skin or clothing deeper into the tissues. Even a superficial brush burn may give rise to tetanus (as in a case in Ashhurst's experience) provided the skin or the vulnerating surface carries tetanus bacilli.

2. *Care of the wound* is the first step in the prophylaxis of tetanus. It is Ashhurst's firm belief that efficient care of the wound as soon as possible after its receipt is by all means the most important feature in prophylaxis. The report by Clark¹ of 100 consecutive cases of punctured wounds of the foot, produced by nails, without a single bad result, and the fact that no tetanus antitoxin was employed, indicates the efficiency of prompt and proper care of the wound. (a) Mechanical cleansing (débridement; extraction of foreign substances; excision of devitalized tissue) and (b) chemical disinfection (3 per cent alcoholic solution of iodine) remains, in his opinion, the best agent for this purpose; certainly no cauterizing agent should be used, as this will produce more dead tissue.

3. *Prophylactic use of antitoxin* holds second place, but second only to care of the wound.

There are three factors to be considered in connection with the prophylactic use of the antitoxin: (a) The quantity to be administered; (b) the site of the injection; and (c) the frequency with which it should be administered.

(a) The quantity of the injection: The usual prophylactic dose is 1500 units, U. S. A.

(b) The site of the injection: Usually it is administered subcutaneously. It is better, however, to administer it intramuscularly in the immediate vicinity of the wound in order to flood these tissues with antitoxin, even before the absorption of toxin has begun. The antitoxin so injected finds readier access, it is believed, to the nerves of the wounded part, and is admitted to the circulation no less rapidly than when administered by the subcutaneous route.

(c) The frequency of the injection: The first injection should be given as soon as possible after the receipt of the wound. In military surgery the first injection almost always can be given some hours before proper care of the wound can be instituted. This fact is fortunate for the wounded man because of the frequency with which operation must be delayed; but in neither military nor civil life does this in any way impair the doctrine that proper care of the wound is the more important of the two factors in the prevention of tetanus.

That tetanus may develop after the prophylactic use of antitoxin cannot be denied; but such cases rarely develop very soon after the injury, and when they do appear seem to be less severe than most cases in which no serum has been administered.

These early postserum cases, a class which our French colleagues have happily named *tetanos post-serique precoce* are certainly rarer than the late postserum cases (*tetanos post-serique tardif*); and it is

¹ Boston Medical and Surgical Journal, 1916, 176, 541.

undoubtedly due to the nearly universal employment of serum prophylactically that we must attribute the relative frequency, during the German War, of forms of tetanus rarely encountered in civil life; I mean the late, the local, the recurrent and the chronic forms of the disease.

He believes it is incumbent on surgeons to administer a reinjection of serum to such patients at the time of late operations on parts which have been wounded, and especially if there is a retained foreign body or a dense cicatrix rendering all the more likely the continued but latent existence of tetanus bacilli or their spores.

C. TREATMENT OF TETANUS. The importance of recognizing the disease promptly can never be overemphasized. Premonitory symptoms must be recognized, and heroic treatment instituted without an hour's delay.

I. Removal of the source which supplies the toxin. If this source is known it should be attacked directly: The wound should be widely opened and mechanically cleansed of foreign bodies, sloughs, etc. Then it should be treated with antiseptics, and he believes a 3 per cent alcoholic solution of iodine is the best. The wound should then be filled loosely with gauze soaked in the iodine solution. Caustic should be avoided, as favoring the growth of tetanus bacilli by the formation of sloughs. If the nature of the case demands it for other reasons, amputation should be done; then the stump should be left open and treated as the original wound. Probably in many cases it will be well to follow Porter and Richardson's suggestion (1909) to excise the related lymph nodes, particularly if they are palpably enlarged.

In the case of a firmly healed wound, on the other hand, it probably will prove more detrimental to the patient to undertake any formal operation than to leave *in situ* deeply placed and apparently well-encapsulated foreign bodies.

II. To neutralize the toxin the best remedy is antitoxin. But here, again, as in the question of its prophylactic use, we must inquire as to the quantity, the site and the frequency of the injection.

1. *Quantity of Antitoxin Injected.* No matter what the method of injection, the most important thing is to get the maximum quantity of antitoxin indicated into the patient's body as soon as possible. Delay even of a few hours may determine a fatal result: 15,000 units given within the first three hours after symptoms develop are of more use than 50,000 units given after six hours, or given in divided doses. It should be made a rule to administer the total quantity indicated as nearly as may be all at one time; and after this overwhelming dose of antitoxin has once been given, to keep the patient's system supplied with antitoxin, though in moderate amount, until his recovery seems assured. Dean¹ found the physiologic action of antitoxin in the blood serum could still be demonstrated as long as twenty, thirty and even thirty nine days after a single intravenous injection (30,000 units, U. S. A.).

As will be pointed out below, if the antitoxin is administered subcutaneously immense quantities are indicated. For an adult, with the

¹ Lancet, 1917, 2, 673.

usual type of case, at least 100,000 units are required in the first twenty-four hours; although a less amount may be sufficient for a child or for a comparatively mild case, one cannot be sure of the fact, and it is better to give too much than not enough. Administered intravenously, a less amount is sufficient, probably 15,000 to 25,000 units should be administered at first, and if no effect is apparent, or if the good effect wears off, a similar amount should be given after the lapse of eighteen to twenty-four hours. If injected intraspinally, from 3000 to 10,000 units should be given, according to the weight of the patient; this injection need not, as a rule, be repeated in less than eighteen to twenty-four hours. Even when administered intraspinally, a certain interval must elapse before the effect of the antitoxin can be apparent. Intraneural injections, rarely used at present, should be made in as great amounts as the nerves will absorb. He has injected 1500 units into the sciatic nerve all at one time, on several occasions, and 750 units into each of the anterior crural and obturator nerves. If the injections are slowly made, all this quantity can be introduced among the nerve fibers.

2. *Site of Injection of Antitoxin.* The following sites of injection deserve consideration: (a) Subcutaneous, (b) intraneural, (c) intravenous and (d) intraspinal.

(a) Subcutaneous injections: Thus administered, the antitoxin is absorbed by the lymphatics, transported to the veins, passes through the lungs, and finally is distributed through the arterial system to all parts of the body. Only an infinitesimal amount ultimately reaches the motor nerves through which the toxin is being carried to the spinal cord, while the greatest part is distributed to the viscera where it is of no use. This method of administration is inferior to the intravenous in the certainty and rapidity of a neutralizing circulating toxin, and since overwhelming amounts are required to produce any effect it is evidently the height of extravagance so to employ it. Should it be used, at least 100,000 units, U. S. A., should be given in the first twenty-four hours.

(b) Intraneural injections: Since the more general adoption of intraspinal injections, the intraneural method has been less used. As it is a well-ascertained fact that most, possibly all, of the toxin reaches the spinal cord only by travelling up its nerves, it is theoretically logical to inject the antitoxin into the nerves in order that, like the toxin, it may not only block the nerves against further absorption but may reach the spinal cord by the easiest road. That it will reach the cord admits of no doubt (Sawamura, 1909). Accordingly, it should be injected into the nerves at the roots of the limbs.

But as it is manifestly impracticable to expose and inject antitoxin into all of the nerves throughout the body through which toxin is being absorbed, and as it is extremely probable, even if not categorically proved, that antitoxin, when injected intraspinally, acts upon the toxin already in the nerve roots or spinal cord, it is nearly everywhere admitted that intraspinal are of more value than intraneural injections; they are especially valuable when the site of inoculation with tetanus bacilli is doubtful or unknown. The only methods we possess for

reaching all the nerves at once are: (1) Intravenous injections and (2) intraspinal injections. In no case, therefore, should we depend on intraneural injections alone. Pratt¹ adopted in 1 case injection (15,000 units) into the vertebral artery; one artery, he claims, delivers blood to both sides of the body. The result is not given. He points out that the circulation from this artery goes chiefly to the medulla and cord, very little to the brain. Cocaine injected into the common carotid anesthetized the head and neck without medullary involvement; so he assumes that the circulation through the circle of Willis is not free in either direction.

(c) Intravenous injections: The effects of these were studied experimentally by von Graff (1912) and subsequently by numerous other investigators. It is the surest and quickest way to neutralize the circulating toxin, and thus to prevent more of it from reaching the nerves and spinal cord; but it does not enable antitoxin to overtake and neutralize toxin already in the nerves or spinal cord, and it is the latter toxin, not the circulating toxin, which is doing the damage.

We reviewed last year the work of Teale and Embleton,² who came to the conclusion, as the result of their experiments, that antitoxin does not pass to the central nervous system by way of the bloodvessels, but that it acts simply by combining with the circulating toxin and thus prevents it from reaching the central nervous system. It is true that Dean³ proved that antitoxin may be found in the cerebrospinal fluid in varying, but never very large, amounts after the intravenous administration of large amounts; but if it is of any value in the cerebrospinal fluid it certainly is more rational to insert it directly by lumbar puncture in concentrated form, than to administer it intravenously.

(d) Intraspinal injections: First used successfully in 1899 by von Leyden, who had no doubt that antitoxin was conveyed rapidly to the medullary cells after its injection into the subdural space of the lumbar cord. It is a method which is in danger of being neglected, owing to modern experimental researches. But in spite of the large majority of experiments, which at first sight tend to show that the intraspinal administration of antitoxin is of no therapeutic value, because it cannot be absorbed from the cerebrospinal fluid, there is sufficient clinical evidence on record to show that antitoxin can be and is absorbed into the nerve roots or cord directly from the cerebrospinal fluid.

The clinical results of the intraspinal use of antitoxin are these:

RESULTS OF TREATMENT BY ANTITOXIN INTRASPINALLY.

Author.	Patients.	Recovered.	Died.	Mortality. Per cent.
Luckett, 1904	4	4	0	0
Rogers, 1905	7	4	3	43.0
Hofman, 1907	16	14	2	12.5
Permin, 1914	28	11	17	60.7
Nicoll, 1915 (collected cases) . .	20	16	4	20.0
Gibson, 1916	4	4	0	0
Ashhurst, 1920	14	9 ⁴	5	35.7

¹ New York Medical Journal, 1918, 107, 737.

² Journal of Pathology and Bacteriology, 1919, 22, 50.

³ Lancet, 1917, 1, 673.

⁴ One patient died subsequently of pneumonia.

It is true that in most of these patients antitoxin was given also by other routes besides the intraspinal (*i. e.*, intravenously and subcutaneously), and that other proper methods of treatment were not neglected (use of sedatives, careful nursing, etc.) for tetanus is a terrible disease and must be fought with every available weapon. It must also, however, be borne in mind that the above list includes (at least in the case of the present writer's statistics) patients to whom antitoxin was given intraspinally so late that it is scarcely fair to include them in seeking to determine the value of this avenue of administration. If treatment is both efficient and early, the mortality from acute tetanus probably should not exceed 20 per cent.

3. *Frequency of the Injections.* If the rule already enunciated be followed, namely, to administer the total quantity indicated, as near as may be, all at once, and particularly if the intraspinal (3000 to 15,000 units) and intravenous (20,000 to 30,000 units) methods are employed, the injections will not need to be repeated very frequently. Intraspinal injections usually are to be repeated every twenty-four to thirty-six hours unless improvement commences; the intravenous injection need not be repeated for several days if improvement commences, but, if the patient continues to get worse, and certainly if a less amount than 20,000 units has been injected at first, this amount should be repeated within twenty-four to thirty-six hours.

III. The third indication in the treatment of tetanus is to depress the functions of the spinal cord. This is equally important with the effort to eliminate the supply of toxin, and with those to neutralize the toxin already formed, because, in almost every case, there is a large amount of toxin which has become impregnably entrenched in the central nervous system, particularly in the spinal cord, and none of the methods of treatment hitherto discussed has any influence over it. Until its action is exhausted, it continues to stimulate the motor and, to a less degree, the sensory tracts of the spinal cord, and kills the patient by exhaustion.

We have at our disposal a number of drugs whose main therapeutic action is to render the spinal cord less susceptible to stimulus; and administration of one or more of these remedies forms an integral part of any rational plan for the treatment of tetanus. The drugs most often employed are chloral, chloretone and similar products; the bromides; magnesium sulphate; and, of late years, the persulphate of sodium. These drugs are to be administered until the therapeutic effect which is desired has been obtained.

Ordinary doses are not sufficient, but it is quite possible to kill the patient by an overdose. In 9 patients in my own series of cases the condition at death was noted: Only 3 patients died in spasm or convulsion, while 6 died in complete relaxation; and in some of these cases the condition was due to overdoses of the spinal depressants employed. Especially dangerous, I believe, is magnesium sulphate, which, as Berard and Lumiere¹ express it, is efficient only in a "doses para-

¹ Presse médicale, 1918, 26, 469.

mortelles." Chloral, in doses of 4 to 10 gm. daily, is the most efficient and inoffensive of spinal depressants, and Ashhurst habitually employs it in conjunction with the bromides.

IV. The patient, as well as the disease, must be treated; but it is perhaps unnecessary here to dwell further upon nursing, feeding and meeting every untoward symptom as it arises.

During the interval between March 22, 1916, and December 7, 1921, 49 patients with tetanus were admitted to the Los Angeles County Hospital. During this interval there were 74,393 total admissions, or 1 admission for tetanus to 1518 admissions for all other causes. Twenty-six deaths occurred, or a mortality of 53 per cent. Stone¹ has made an analysis of the records of these 49 patients and concludes:

1. The most important factor in the treatment of tetanus is its prevention. It should be the universal rule to give a prophylactic dose of 1500 units of antitoxin to all patients who have received lacerated or penetrating wounds. If the wound contains necrotic tissue or a suspected foreign body the dose should be repeated in ten days and subsequently if operation on the wound is contemplated.

2. Treatment of all extensive lacerated wounds surgically by primary excision and primary or delayed suture will greatly reduce the incidence of the disease.

3. The type of infection appears to vary in virulence in different years. In four different years between 1916 and 1921 the mortality varied from 14.3 to 71 per cent in a comparable number of patients each year, with the same general plan of treatment.

4. When symptoms of the disease have appeared the attempt should be made to saturate the patient with antitoxin before fixation of toxin has occurred in the nerve cells of the spinal cord. This can best be accomplished by intraspinal and intravenous injections during the first three days of treatment.

PREVENTION OF TRISMUS IN TETANUS. Moser² reports brilliant success in a case of severe tetanus, in which he combated the tetanic closure of the jaw muscles by injecting locally an anesthetic as if for local anesthesia. The tetanus had developed the twenty-second day after the man's hand had been crushed in a machine. The second day of the trismus Moser injected 25 cc of a 0.5 per cent solution of procaine (novocaine), distributed in both masseters. In a few minutes the previously tightly locked teeth could be opened and the man could eat and drink at will, which had been absolutely impossible before. The effect began to subside in an hour, and by the afternoon the teeth were clenched as tightly together as before. At 5 P.M. another similar injection was made, this time above the malar bone, pointing the needle downward in three different directions. The effect was as prompt and as decided as after the first, and the patient was able to eat and drink. Two local injections were required on the four following days. As the effect of the local anesthetic lasted only for an hour by that time, a change was made to eucaine. The effect of this was less prompt but it lasted longer;

¹ Journal of the American Medical Association, June 24, 1922, No. 25, vol. 78.

² Abstract, Journal of the American Medical Association, No. 21, vol. 77, p. 690.

one injection in the morning answered for the whole day. By the nineteenth day the local anesthetic was no longer needed. He had been given twenty injections of antiserum, 100 units each, and also morphine, phenobarbital and camphor at times.

In a second case the local anesthetic conquered the trismus at once in the same way, but the boy, aged twelve years, could take nothing but fluids on account of the spasm of the swallowing muscles. He succumbed the second day to paralysis of respiration.

INTRACRANIAL SEROTHERAPY IN TETANUS. Frankel¹ reports the recovery of several very grave cases of tetanus after the subdural injection of antitetanic serum by combined lumbar puncture and trephine of both hemispheres. In 1 case the incubation period had been only forty-eight hours, recovery following this treatment. Experimentally, Gottlieb saved rabbits by trephining and injecting the antitetanic serum in the vicinity of the medulla oblongata after an interval of sixty hours from the time of injection and twenty-four hours after the onset of the symptoms. Five out of Frankel's 7 grave cases recovered. He further cites 2 of Bocker's and another of Slojonoſſ.

Surgical Tuberculosis. Our interest in surgical tuberculosis has been gratified during the last four years by the opportunities afforded as consultant to the State Tuberculosis Sanatoria of Pennsylvania.

The unfavorable results which generally follow radical surgical treatment of tuberculosis has been impressed upon us as never before, and we feel that the attention of surgeons should be called to the article of Gauvain, which is quoted freely.

THE NON-OPERATIVE TREATMENT OF SURGICAL TUBERCULOSIS. After a period of enthusiasm for the surgical treatment of tuberculosis, involving bones, joints, glands or other accessible structures, there has come one of reaction in which even the active surgeon, worn by tragic experience, has withheld surgical interference until forced to procure mechanical relief of pus under tension, even at the risk of a possible mixed infection. Gauvain² confines his remarks to tuberculous disease of the bones, joints and glands and he states that non-operative treatment in these conditions may be adopted with confidence and reasonable assurance of success, and as he bases his remarks upon a series numbering between 2000 and 3000 cases between the years 1908 and 1921, they are worthy of critical attention. Gauvain holds that operative treatment of an active tuberculous lesion is unwarranted by the pathology of the disease. A tuberculous lesion provokes a reaction, consisting in the formation of a zone of resistance about the focus of the disease, and it is not reasonable to mechanically break down this natural tissue resistance. Sir Anthony Bowlby, in 1908, in an address at Nottingham, reported 900 cases of tuberculosis of the hip-joint at the Alexandra Hospital, with a mortality of less than 4 per cent, obtained by abstention from major operations in active tuberculous disease and an aseptic technic in such minor operations as were indicated. Bowlby at that time laid stress upon the fact

¹ Medizinische Klinik, Berlin, March 26, 1922, No. 13, vol. 18.

² Lancet, May 21, 1921.

"That tuberculous joint disease is arthritis occurring in a tuberculous patient, and is not merely a joint affection." This is the keynote of, and justification for, non-operative treatment of surgical tuberculosis. It needs the greatest possible emphasis, for even to this day there is too great a tendency to concentrate unduly on the local lesion and disregard the fact that the patient himself has contracted a general disease, of which any particular lesion or lesions are merely local manifestations. Gauvain feels that no striking advance has been made in the operative treatment of acute tuberculous bone and joint disease unless bone-grafting of the carious spine be considered as such. This operation, however, is essentially a conservative measure. No attempt is made to deal with the lesion, but an internal splinting of the bone is secured. In the majority of cases Gauvain feels that it is an unnecessary operation if reasonable facilities are available for treating the patient; in certain cases it has distinct and considerable dangers, and to his mind only in a limited number of cases does it present definite advantages. It is really immobilization of a tuberculous lesion instead of an extirpation. The psychology and future well-being of the patient have been almost totally neglected in the routine treatment of this disease. The monotony of immobilization, of long-enforced recumbency, of fixation in unnatural attitudes, cries for alleviation. A state far from that we see in the normal healthy well-cared-for child, who is happy when he is given full play for natural healthy mental and physical activity. In addition to the surgical treatment of the disease, equal attention, therefore, should be paid the *child's education, manual instruction and amusement*, and they should be taught how to amuse and entertain themselves. He warns against opening tuberculous abscesses of any of the larger bones or joints, but neither should they be left to be absorbed. As soon as possible after their formation and as early in the evolution as the skill of the surgeon permits they should be aspirated. All patients who have suffered from surgical tuberculosis should have the continued advantage of occasional skilled supervision. No special hospital for the treatment of these conditions can be considered complete unless it possesses an out-patient department where discharged patients may be periodically examined, advised and assisted. Not only is medical help required, but advice in the choice of occupation and assistance in obtaining suitable employment should be at hand. The mortality percentage in this group of 3000 cases was 2.54 per cent. The mortality of tuberculosis of the spine was 3.39; of the hip 1.71. Meningitis is the most common terminal cause of death. Gill¹ says this is in accord with his experience at the Wiedner School for Cripples. Spinal tuberculosis was not only the most common but also the most fatal form of tuberculosis. Ten of the 13 patients suffering from spinal tuberculosis, whose death resulted from meningitis, were under the age of five years. In conclusion, Gauvain says that surgical tuberculosis is more difficult to treat, is more likely to produce physical disability and is undoubtedly more fatal in the very young than in older children.

¹ Personal communication.

Factors in Wound Healing. The healing of wounds¹ after injury involves the regeneration of certain tissues. In this process there is a resumption of the proliferation of cells. It requires little argument to indicate the importance of knowing what factors are concerned in the regeneration processes, for they involve the facility with which repair may go on in the organism and the speed with which the healing can be accomplished. Any study of the cicatrization of the wound is, therefore, something more than a consideration of a mere academic question. Carrel² has pointed out that the resumption of cell proliferation in wounded tissues may be attributed, as Welch³ suggested long ago, to the removal of resistance to growth, in consequence of the defect resulting from loss of tissues. In other words, he writes, "The removal of the products of growth, that is, of a portion of the tissues, immediately reinaugurates the growth process, just as the removal of the products of a balanced chemical reaction at equilibrium immediately reinitiates the forward action." This means that regeneration, being a direct consequence of the injury, is started by forces within the organism.

This is not the only hypothesis, however, which will account for wound repair. It is equally conceivable and logical that external factors may promote or initiate the cicatrization phenomena. On this view the cells would be directly stimulated to growth and multiplication by forces outside the organism, acting on tissues deprived by injury of their natural protection. In experimental investigation of the problem at the Rockefeller Institute for Medical Research, Carrel has tested the first hypothesis by watching the progress of repair in wounds protected against all external irritation. He found that as long as the wounds were protected by a connective-tissue dressing against mechanical, chemical and bacterial irritation, no evidence of cicatrization was found. Admitting uncertainty whether cicatrization could be prevented for any indefinite period, Carrel believes there is no doubt that the mechanism of regeneration is not set in motion at the usual time, when all external irritations are suppressed. It appears, he adds, that, under ordinary conditions, cicatrization is not initiated by an internal factor.

On the other hand, the local application of certain irritants, such as turpentine, or the presence of bacteria tends to reduce the initial delay in wound repair—the latent period of regeneration. We are reminded that a small wound will begin to cicatrize sooner if slightly infected, as practically always happens, than if it were thoroughly protected by a non-irritating dressing. Perhaps Carrel is correct in believing that the mechanism of regeneration has become adapted to the ordinary condition of life where infection or irritation of wounds is likely to occur. In any event, he is presumably justified in the conclusion that regeneration apparently is initiated, not by internal, but by external factors.

¹ Editorial, *Journal of the American Medical Association*, No. 25, vol. 77.

² *Journal of Experimental Medicine*, November, 1921, 34, 425.

³ *Science*, 1897, 5, 813.

Aseptic and Antiseptic Surgery. Cabot¹ states that the average surgeon is so greatly concerned with bacteria as the cause of infection that he may overlook some of the other conditions which predispose to it. For the development of infection, conditions must favor the growth of bacteria; their mere presence will not always be sufficient. The surgeon who centers his attention on asepsis and its various aspects is apt to attribute a postoperative inflammation to incomplete sterilization. While a certain small percentage of such infections are due to faulty asepsis, various other factors are of great importance. The surgeon is responsible not only for his liability to introduce bacteria, but for his failure to protect the patient from conditions which make infection possible.

Such conditions may be either general or local.

The general conditions, which cause a decrease in resistance, are:

1. *Fear.* A patient who goes to operation with great dread and anxiety is much more liable to have a poor result than one with the opposite attitude.

2. *Starvation.* This is not so often a factor as formerly, as today patients are allowed more nourishment. The diet should not be restricted, especially in the case of patients at the extremes of life.

3. *Dehydration.* Water should be supplied in great quantities not only up to the time of operation, but even during the surgical treatment and afterward. If it cannot be taken by mouth it should be given by rectum and subcutaneously.

4. *Anesthesia.* The anesthetic should be carefully chosen and should be administered by an expert. Ether is not always the logical anesthetic simply because it is the most fool-proof.

5. *Length of Operation.* The time consumed in the operation depletes the patient's vitality. Especially under prolonged ether or chloroform anesthesia there is a very unfavorable action upon the tissues, with lessening of the alkali reserve and at least some acidosis. The work should be done with as much speed as is consistent with thoroughness and correctness of technic. Naturally slow operators, who cannot acquire speed, should take up some other calling than surgery.

The local conditions favoring infection are:

1. *The Preparation of the Skin.* This should be simple. Irritating applications should be avoided.

2. *Rough Handling of the Tissues.* This is, perhaps, the most important local factor favoring infection. Roughness in handling, the use of dull instruments, grasping a mass of tissue to control bleeding, and heavy, careless dragging with retractors should be avoided as they cause tissue necrosis which produces a good culture medium.

3. *Faulty Hemostasis.* Dry wounds heal quickest and with least infection.

4. *Mass ligatures,* which destroy the tissue surrounding a vessel.

Standardized Results of Wound Healing. Gibson² has made a study of wound healing in his hospital service, and by systematizing the

¹ Canadian Medical Association Journal, 1921, **11**, 610.

² Transactions of the American Surgical Association, 1921, **39**, 465.

records and adopting a standard of greater accuracy than is usually obtained, he has been able to study the problems of imperfect wound healing and methods of correcting them. It is a monthly record and does not include all of the cases, but a limited group of what might be called the ideal type, that is, no conditions of possible infection from the disease itself, as acute appendicitis, salpingitis and drainage wounds of any kind.

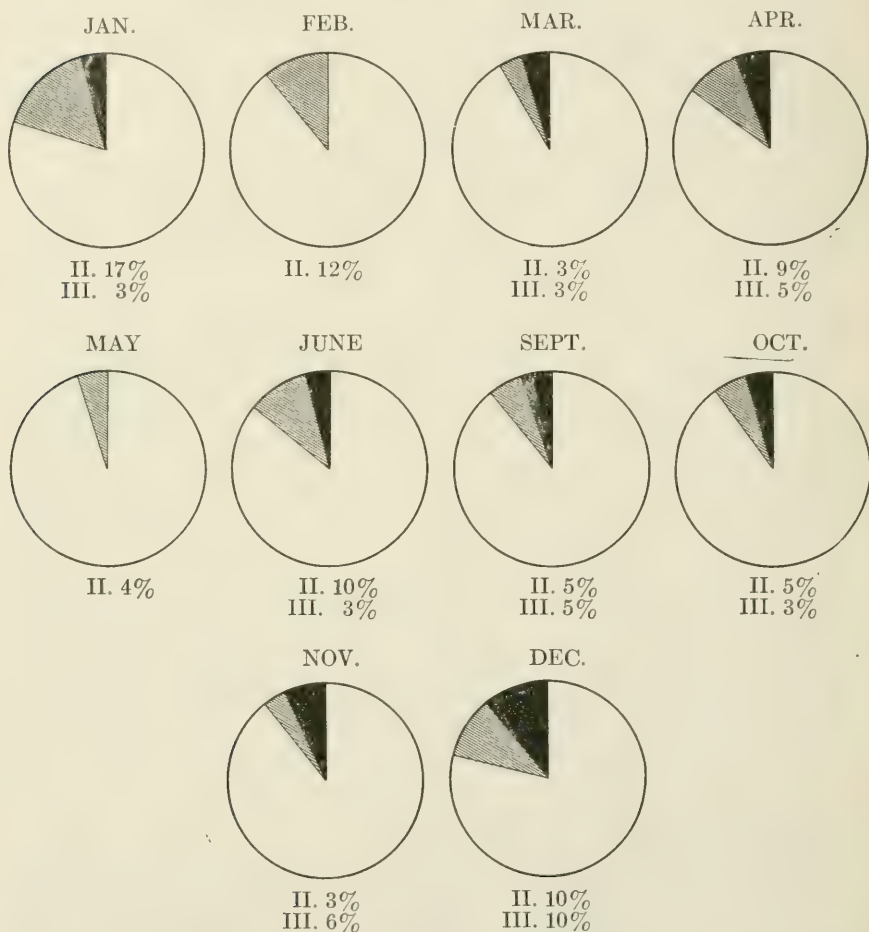


FIG. 8.—Results of wound healing—1920. Class I (white). Ideal wound healing. Class II (shaded). Slight mishaps. No detriment to wound healing. Class III (black). All infections. (Gibson.)

Manner of Tabulating the Results. The material is divided into three groups: Grade 1 represents absolutely irreproachable wound healing. Grade 2 represents small disturbances of wound healing, such as small hematoma or trivial infection, but none of these accidents delaying the healing beyond the normal period. Grade 3 represents all other cases, that is, all infections.

He feels that it is particularly important to differentiate between hematoma, classified under Grade 2, and infections of Grade 3, as the Grade 2 mishaps, are more apt to represent individual errors, while Grade 3 may well be laid to a faulty system.

Manner of Grading. They are made by Gibson personally during weekly rounds. If wounds are definitely healed, say at the end of seven or eight days, the grade given is usually final. These notes are all given in the presence of the entire staff, and if any possible dissension exists the consensus of opinion rules. At the end of the month the results are tabulated as indicated in Figs. 8 and 9. At the monthly conference a discussion of the causes of disturbances of wound healing takes place.

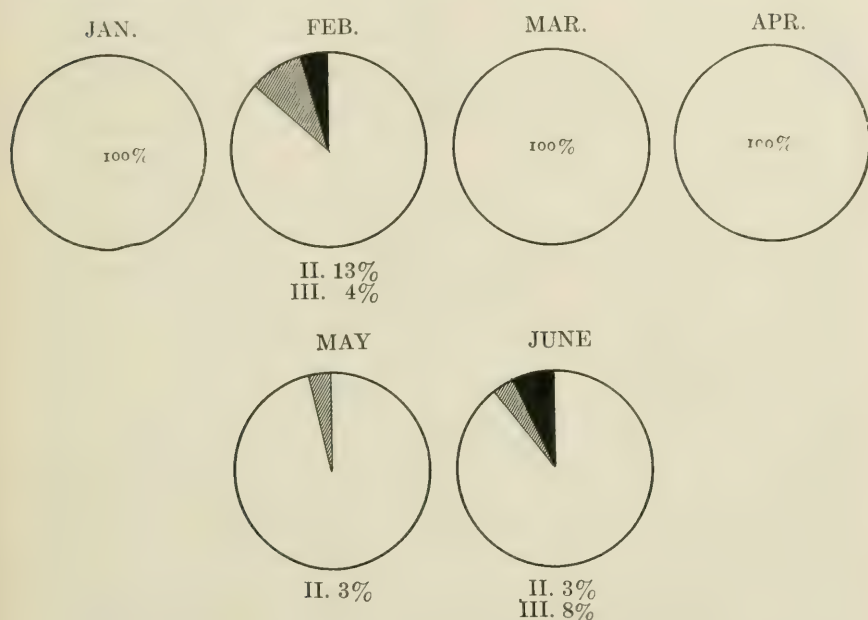


FIG. 9.—Results of wound healing—1921. (Gibson.)

Of the 437 cases classified as to wound healing, there were 39, or 9 per cent, with disturbances. Grade 2—25, or 6 per cent; Grade 3—14, or 3 per cent. His object in publishing his report is to emphasize the great importance in a hospital service of systematically carrying out such an investigation. He feels that, from their experience, it has been a stimulus to every operator and has been most helpful to both the patient and the surgeon.

As the German literature is becoming accessible it is possible to obtain reports of their war surgery.

On the first day of the German Surgical Congress, Berlin, May 10, 1922, Lexer¹ spoke upon GENERAL SURGICAL INFECTION, and differ-

¹ Berlin correspondent, Journal of the American Medical Association.

entiated two principal groups: Bacterial infection and general toxic infection. These two forms of infection overlap, to a certain extent, but the distinction is a practical one. Then there are mixed types of the first and second groups, which were in the past referred to as septicopyemia. Fever is not necessarily the expression of a general infection, but may be of a toxic nature (resorption fever). Changes in the clinical picture will establish the diagnosis. Demonstration of bacteria in the blood furnishes the final proof; the absence of bacteria points to the toxic type. If there are bacteria in the blood and the number is increasing, it is of little importance whether the augmentation takes place in the blood or whether new bacteria are being continually thrown into the blood stream from an outside focus. Lexer thinks that the active increase of bacteria in the blood is an established fact. It is worthy of note that the severest acute types of bacterial general infection may persist for some time without developing metastases. However, metastatic types are often less dangerous. There is a certain relationship between metastases and resorption fever—the resorption of bacteria.

General toxic infection may be divided into infection from animal toxins, infection from bacterial toxins and infection from so-called tissue toxins. An example of the first group is snake venom; of the second, tetanus, and of the third, the toxins associated with burns. A separation of bacterial toxins and tissue toxins is important. There are also transitional forms. Not all pathologic manifestations are traceable to bacterial toxins.

In this connection, a number of questions arise that still await solution; for example, whether the tissue toxins alone play an important role and to what extent they break down the defense measure of the organism. They often act after the manner of foreign protein, producing fatigue phenomena and similar manifestations. Injection of tissue toxins into animals causes local signs of inflammation. These phenomena often take on the form of anaphylactic symptoms. Possibly we have here an explanation of the vasotonic effect brought about by the parenteral administration of proteins. Also, the action of shock may possibly often be explained by intoxication through decomposition products (toxemia traumatica). In any event, a separation of the tissue and bacterial toxins must always be sought.

According to the statements of Eden, with regard to inflammatory processes and wound infection from the standpoint of physical chemistry, the organism endeavors to counteract disturbances by sending to the part affected an increased supply of blood. Thus, hyperemia may bring about an adjustment in the inflamed area in which the physico-chemical disturbances (for instance, in the form of an increased hydrogen-ion concentration and an augmented osmotic pressure) find expression. Therefore, we should not, in such cases, use substances intended to combat hyperemia—not even though they be bactericidal. The preservation of nerve conduction is important in connection with hyperemia, as is shown in roentgenograms depicting the healing of artificial fractures with and without severance of the

sciatic nerve. If the nerve is not severed there is hyperemia, and callus appears by the end of two weeks; otherwise, not until a much later period. We should employ substances that attract leukocytes instead of repelling them, as we need the leukocytes to heal the wounds. In this connection, the influence of electrolytes, through the rearrangement of ions, and also the conditions of osmotic pressure play an important part. In an acutely inflamed area, in the presence of marked hypertonia, edemas and impeded influx of blood, we must not employ such substances as increase the pressure of the tissue proteins due to the absorption of moisture, which accentuate metabolism, or bar the road for the elimination of injurious metabolism products, even though such a substance may exert a bactericidal action; otherwise, an incision will be required to relieve the tension and save the tissues.

In the case of chronic inflammations, on the other hand, an accentuation of the inflammatory processes will bring about an adjustment of the disturbances and lead to a cure. Physio-chemical processes also exert a decisive influence in the destruction of bacteria and in the formation of toxins. Only with the possession of an exact knowledge of these processes and their bearing on the healing process in wounds will it be possible to discover a clinically useful disinfectant; and it must be borne in mind that the processes to be noted in a fresh wound are different from those in an inflamed wound, and that these, in turn, differ from the reactions in the test-tube.

Surgical Sterilization of Wounds. Butler¹ restates the theory of surgical sterilization, or débridement, in recent, grossly contaminated wounds, which we have reviewed at length during the last three years.

Débridement is not a simple procedure. It requires time and, in the very great majority of cases, general anesthesia. It demands also more than average surgical ability. The aseptic precautions require a degree of teamwork which can be obtained only by long practice. Early in his experience the surgeon should delay closure of the wound for a few days following débridement, but as his skill increases he may add immediate primary suture.

Military surgery established the fact that it is safer not to close wounds in which great numbers of streptococci or fecal anaërobes are found. In civil hospitals, unless it is known that the patient is willing to remain in the institution for from seven to ten days, immediate primary suture should not be attempted. Moreover, immediate primary suture in cases of metabolic disturbances, vascular changes, chronic alcoholism, or demonstrable syphilis does not promise great success. Delayed primary suture or antiseptic treatment is a wiser course.

An infected wound requires more skilled attention than a clean wound, and in a contaminated wound the prevention of infection is a still more difficult problem. Given proper technic, sound judgment, and increasing skill in débridement, a successful result should be obtained in 90 per cent of the cases.

¹ American Medicine, 1921, n. s., 16, 295.

Treatment of Acute Suppuration. Saner¹ states that the constant use of the word drainage is probably responsible for the general acceptance of the principle that drainage is the chief factor in the treatment of suppuration. Saner suggests that this term drainage should be eliminated and replaced by "relief of tension," which does not suggest evacuation by means of tubes or wicks, but implies an opening, along which the products of inflammation may escape. The second great principle, after the relief of tension, is rest or immobilization. Only by completely immobilizing an inflamed part are the natural tissue forces given a chance to form barriers against the spread of inflammation and thus localize the process. This principle not only applies to soft tissues, but is demonstrated to the maximum degree in bone. Tension here is at the maximum because of the unyielding character of the bony wall surrounding the medullary cavity. In joints, aspiration may, in many instances, give sufficient relief of tension.

Experimental Research in Wound Drainage with Dry and Moist Dressings. Schoenbauer and Demel² report an experimental investigation of the influence of drainage by rubber tube, iodoform gauze strips, or a wick, upon the entrance of pathogenic bacteria into simple wounds or the larger hematmata when dry and wet dressings are used.

They conclude that rubber drain favors the entrance of bacteria present on the skin, that iodoform gauze does the same, but in less degree, and wick drainage opposes bacterial advance. In cases of gauze and wick drainage, moist dressings appear to retard the entrance of bacteria.

Physiologic and Therapeutic Action of Light. Universal experience has demonstrated the benefits of heliotherapy in whatever primitive forms it has been applied, and probably it is the oldest of all forms of therapy. More exact modern methods have served to support the experience of the ancients, and the recent experimental study³ of rickets has furnished a most remarkable instance of the definite, if inexplicable, etiologic relation and therapeutic effect of light. As stated by Hess,⁴ in his review of this topic, the experimental production of rickets by defective diets may be determined or prevented by sunlight or artificial light of sufficient intensity and proper quality, and human rickets may be improved or cured by the same agency. The frequency of rickets in negroes and the dark-skinned white races occupying northern cities evidently depends partly on defective nutrition and partly on the shutting-out of the sunlight by the pigment intended to protect them from excessive doses of light in their native habitats. Heliotherapy in tuberculosis has also taken a definite place in therapeutics, while the therapeutic effects of radiant energy in other forms is, of course, one of the most rapidly growing aspects of medicine, often leaping far ahead of any safe experimental foundation.

¹ *Lancet*, London, October 29, 1921, **2**, 891.

² *Arch. f. klin. Chir.*, 1921, **116**, 731.

³ Editorial, *Journal of the American Medical Association*, May 6, 1922.

⁴ *New Aspects of the Rickets Problem*, *Journal of the American Medical Association*, April 22, 1922, **78**, 1177.

A thorough review of the subject of the physiologic action of light, by Janet H. Clark,¹ is, therefore, most timely. We learn that despite the long history of heliotherapy, the first systematic effort to study the biologic effects of light, and its therapeutic uses, was made by Pinsen, when he founded his light institute in Copenhagen in 1896. Most valuable work, both theoretical and practical, has been done there since, with special success on the therapeutic side in the treatment of lupus, but the fundamental problem of the mode of action of light on the living cell remains unsolved. Although there is a universal conviction that sunlight is healthful, it is certain that human beings and animals can live a long time in darkness without any noticeably bad results. Blessing, who acted as physician to Nansen during his expedition in the Fram, published a report showing that members of the party exhibited no evidence of anemia during the trip. More recently, Grober and Sempell examined horses that had worked for years in coal mines, and found no anemia in any case in which a satisfactory nutritive condition existed. But, though the physiologic effect of sunlight seems at first sight indefinite and of dubious importance, the action of far ultraviolet light on normal tissue and the action of near ultraviolet and visible light under certain pathologic conditions, has been investigated enough to show that there are well-defined effects due to light, closely related to the physiologic results of exposure to radium and the roentgen rays.

Recent contributions have come chiefly through study of the biologic effects of light in relation to the wave length of the rays concerned. *In general, the shorter the wave length the greater the physiologic effect.* The spectrum of sunlight reaches only to 290 microns in the ultraviolet, and light greater than 300 microns being our normal environment, it is obvious that any organism ordinarily exposed to this light and easily injured by it would have perished long since. Light less than 300 microns is an unnatural environment, and produces in all living cells strong and often very harmful reactions. Since the effect of light is probably due to the photochemical reactions produced when light energy is absorbed, it is not surprising to find that the various constituents of protoplasm begin to absorb light strongly in the neighborhood of 300 microns. We find that bacteria begin to be killed quickly by wave lengths of 296 microns or below, and hence sunlight contains a few rays short enough to affect bacteria except on prolonged exposure, or at a higher temperature which augments the effect of light.

We do not know the exact nature of the photochemical reactions produced in protoplasm by ultraviolet light, although various clues have been suggested. Bovie finds that paramecia exposed to a sublethal dose of ultraviolet light are so sensitized to heat that they cannot stand, even for sixty seconds, a temperature which is the optimum for the controls. He concludes that death from ultraviolet light is due to heat coagulation following sensitization by radiation. Others have found that the effect of ultraviolet light on protein solutions is to make them less soluble, as indicated by their easier precipitation.

¹ The Physiologic Action of Light, Physiology Review, April, 1922, 2, 277.

Snow blindness depends on the reflection of ultraviolet rays from large areas of water and snow fields, these short rays being absorbed by the cornea and conjunctiva with resulting injury to their protein constituents. Any artificial illuminants, such as the quartz mercury arc and bare metallic arcs, which emit a large amount of radiation of a wave length less than 295 microns, are known to be extremely injurious to the eyes. These short rays are the ones that stimulate the formation of lymphocytes in man and animals, which may be a factor in the heliotherapy of tuberculosis. Light exerts some influence on body metabolism, as is shown by a number of results indicating a change in the amount of carbon dioxide expired, a change in rate and depth of respiration, and an increased rate of growth in the light compared to the dark. However, the effects are not as great as might be expected, presumable because the chemically active rays cannot penetrate deeply.

A remarkable phenomenon produced by light is that of photodynamic sensitization, in which, through the action of various chemicals, the tissues are sensitized, just as one sensitizes a photographic plate, so that they are affected by visible light rays. Among the substances producing this effect is hematoporphyrin, derived from hemoglobin, which so sensitizes animals that sunlight is promptly fatal. Possibly the skin reactions of pellagrins to exposure to light depend on such sensitization.

As yet, relatively little investigation has been made as to how heliotherapy produces its effects in tuberculosis and rickets. In the latter, roentgenoscopy discloses that under the influence of sunlight the recalcification of bones proceeds at an accelerated rate, and chemistry reveals an increase in the inorganic phosphorus of the blood. Cod-liver oil does much the same thing, and it is difficult to understand how sunlight and the oil can produce similar effects.

The physicists and biochemists will have to determine the explanation of the effects produced by the sun's rays; for the clinician it is important to realize that we are only at the threshold of the subject of the physics and physiology of light and that, as these advance, new and probably unexpected therapeutic advances will also come.

Heliotherapy has been gradually introduced at the Mount Alto Sanatorium in Pennsylvania during the last four years, and it is the opinion of the entire staff that tuberculous lesions of the bones and joints have been definitely benefited.

Torraca,¹ experimenting with guinea-pigs at the Institute "Angelo Mosso," on Monte Roa, at an altitude of 9000 feet, made comparison of the results of three kinds of treatment: (1) Uncovered wounds in the shade; (2) uncovered wounds in the sun; (3) bandaged wounds. At the end of twelve days those in Class I had contracted one-third; in Class II, one-half; in Class III, three-quarters. The more rapid healing of bandaged wounds is attributed to the protection from the cold air of the high altitude. The ultraviolet rays abounding in clear mountain air probably have a stimulating effect on healing, as was

¹ Arch. ital. di chir., Bologna, June, 1921, 3, 401.

shown, not only by the greater rapidity of chemical reactions, but also by the method of liberation of iodine from potassium iodide. The solar action may act directly by influence on cellular processes, to which is due the reparation of lost substance; or indirectly, by elimination of any conditions that might disturb healing. Torraca found that within a few hours wounds exposed to direct sunlight show greater contraction than those in the shade; and that solar rays exercise a biologic action favorable to cicatrization of aseptic wounds.

Ahlswede¹ states that, owing to the lack of sufficient sunlight in northern Europe, it was necessary to search for adequate substitutes and these were found chiefly in the Finsen lamp and the mercury vapor lamp. Hensen and Johansen believe the Finsen light approaches nearest to the sunlight in its effect because it contains the same proportion of short wave rays and long wave penetrating rays as sunlight. The mercury vapor lamps, on the other hand, differ from sunlight in that they contain larger groups of violet and ultraviolet rays, as well as a larger proportion of short-waved and less penetrating rays than are found in sunlight or in the Finsen light. The ultraviolet spectrum of the mercury vapor lamps contains such short-waved rays (from 292.5 to 218.6 μ .), which do not exist in either sunlight or the Finsen light. To use the mercury vapor spectrum they must be placed at a distance of one yard, the short waves being absorbed by the air at this distance. When a stimulating effect is desired, as in the treatment of wounds, the short-waved rays may prove useful.

The effect of light on an unprotected skin shows the following visible degrees of intensity:

Erythema due to heat.

Inflammation due to light.

Pigmentation.

The erythema is seen immediately after exposure of the skin. It appears as a hyperemia, which rarely lasts more than an hour and then disappears. Mercury vapor lamps do not cause this reaction as heat rays and are not contained in their spectrum.

The inflammation of the skin produced by light is seen in from five to ten hours after the exposure. The degree of the inflammation depends upon the length of the exposure and the intensity of the light.

As to the pigmentation, this is generally seen in from two to five days. It is really a defensive action of the body against the light. The erythema gradually turns darker, and becomes almost brown. The skin begins to peel off. The skin gets used to the light and its sensibility decreases to such a degree that inflammation of the skin does not occur, even after prolonged and intense exposure to the light rays. This, however, applies only to the Finsen light and sunlight. Mercury-vapor rays always cause erythema and the skin cannot become immune to their influence. The effect of light is not confined to the surface, but is general. Hansen has shown that the Finsen light effects an increase in hemoglobin and in the red blood cells. Hertel demon-

¹ Urologic and Cutaneous Review, September, 1921.

strated that, under the influence of light, the hemoglobin passes its oxygen to the tissues more rapidly.

Effects of Hot and Cold Applications to the Surface of the Body. For generations application of heat and cold have been made for the purpose of more or less influencing the deeply seated organs, but the reasons for and against such procedures have been based purely upon clinical observation and little real scientific research has been directed toward determining the actual effects which are produced. MacLeod and Taylor¹ report investigations which they carried on in the University of Toronto. In a previous report they showed that the application of heat to the surface of the thigh in the rabbit caused an immediate rise in temperature, which spread laterally for about 20 mm. and penetrated into the muscles for about the same distance, when the applied heat was approximately 10° C. greater than the natural heat of the skin. On the surface of the abdomen, when a temperature difference of 15° was applied to an area about one-quarter of the abdominal surface, the temperature changes are induced to a depth of 75 mm., and the lateral spread was 20 mm. They seemed to prove that this rise in temperature was mainly dependent upon the induction of heat through the tissues. This later research was concerned with cold. When cold was applied, which was 20° C. below the normal temperature of the tissues, a fall of 14 or 15° C. immediately under the applicator and the lateral variation in temperature extended to about 20 to 25 mm., which corresponds to that obtained with heat. The drop in temperature was very sharp at first, and there was a quick return to normal when the applicator was removed. They were unable to find that the application of heat or cold to the surface of the body overlying the liver and kidneys resulted in any significant change in the temperature of these organs. Their most significant and important observation was the influence of heat and cold applied to the head upon the temperature of the brain. They found that cold definitely influenced the temperature of this organ, cooling it to a depth of 14 mm. when the cold applied varied from 7 to 10° C. below the normal temperature of the surface. When still lower temperatures were used, the fall of the brain temperature became very marked indeed, falling as much as 3 to 4° C. to a depth of about 14 mm., when the applied temperature was about 25° C. below that of the body. It is interesting to note that the application of heat to the head did not produce as great a temperature change in the brain substance as did the application of cold. These facts have considerable importance from the therapeutic standpoint. It has been believed in the past that the application of cold to the head in the course of fevers at least acted as a comforting agent by producing a pleasant sensation, or by so modifying the circulation in the brain, through the nervous system, this effect was produced. These investigations of MacLeod and Taylor indicate that the temperature of the brain is directly influenced by external applications of heat and cold, and particularly by cold.

¹ Lancet, London, July 9, 1921, 2, 70.

Mechanism of Lowered Resistance following Exposure to Lowered Temperature. Bibb¹ conducted a study for the purpose of ascertaining, if possible, the functional and structural changes which follow chilling of the body surface, and which lead directly or indirectly to disease. The belief has long been held by clinicians and investigators that when the surface of the body is chilled, certain of the internal organs, particularly the respiratory organs, become more susceptible to bacterial invasion. Other authors, after careful investigation, have reached the conclusion that exposure to lowered temperature, of and by itself, may be a complete cause of disease without the intermediation of bacteria. It was, therefore, planned to subject an animal to sudden and severe lowered temperature and to take note of alterations of function or structure, with special reference to the possibility of increased susceptibility to zymotic disease.

The changes provoked in rabbits by the ice-bath are as follows:

Multiple minute hemorrhages in the lungs.

Multiple minute hemorrhages in the stomach.

Changes in blood content of tracheal mucosa.

Contraction, followed by congestion, of the spleen.

Pallor, followed by redness, of the skin.

Albuminuria.

Leukopenia, followed by leukocytosis, in the peripheral blood.

The first five of these changes are apparently caused by vasomotor variation. The remaining two are closely related to vasomotor function.

The following hypothesis is offered in explanation of the increased susceptibility to bacterial invasion brought about by chilling the body surface.

(a) That vasomotor tone and organ function are maintained by the successive functionation of different shifts or relays of cells, each having its own threshold of susceptibility to stimulation and rehearsing its stereotyped function according to the laws of fatigue and its own individual needs.

(b) That vasomotor changes exert a provocative or stimulating effect on tissue cells, causing an increased discharge of function.

(c) That early, though fully developed, inflammation, with all the classic symptoms, is to be explained as excessive liberation of cell function, and this may lead later to exhaustion, incoördination and the consequences of these.

(d) That the cell tends to summate the various similar and dissimilar stimuli playing upon it at each given instant and react to its environment as a whole.

(e) That the vasomotor changes set up by lowered temperature can be summated with the stimulation from relatively harmless bacteria, so as to bring on an excessive liberation of function constituting an inflammation of the affected part.

Shock. Two interesting editorials have appeared in the *Journal of the American Medical Association* during the year and they practically summarize the subject up to the present time.

¹ American Journal of Medical Sciences, 1921, 162, 258.

EXHAUSTION PRODUCED BY EXTREME EMOTION.¹ That the emotions play upon our physiologic reaction is a thesis that scarcely needs to be defended. The digestive secretions, for example, are influenced by psychic states in striking ways to which the Russian physiologist, Pawlow, has forcefully directed attention. The idea of food may become a stimulus for the flow of saliva or even gastric juice, whereas such emotional states as anger, fear and sorrow may succeed in inhibiting the normal secretion. Strong emotions are attended by more or less well-defined changes in the circulation which, in turn, cannot remain without some influence on the tissues reached by the altered blood supply. It is by no means easy, however, to define the part the emotions *per se*, and exertion that accompanies them, respectively, play in producing the consequent exhaustion. Recently, Crile² has summarized the results of his extended experiments in this field, and boldly maintains that emotion causes a more rapid exhaustion than is caused by exertion or by trauma, except extensive mangling of tissue, or by any toxic stimulus except the perforation of the viscera. In a recent issue³ the probable involvement of toxemia in some of the most severe forms of shock was pointed out. As intoxication of a similar sort is less likely in cases of emotional exhaustion, unless the toxic substances are identified as products of fatigue, it may be that shock and "nervous exhaustion" must be more clearly differentiated in the near future. Because prostration is the end-result in either case, it by no means follows that precisely the same causes are at work.

SHOCK AS A RESULT OF TOXEMIA. During the World War the subject of shock early assumed a place of unusual prominence in connection with the surgical problems presented by the injured. The topic was in no sense a new one, for the genesis of surgical shock had already been debated many times and had given rise in a variety of more or less conflicting and inconclusive speculations in medical literature. These earlier hypotheses, as well as more recent ones, were earnestly discussed by physiologists and surgeons in the eventful days of supreme military activity, in the hope of discovering some tenable solution of the cause of shock and of providing some rational procedure for the relief of its threatening symptoms. The history of these efforts has repeatedly been discussed⁴ particularly at the time when the need of more knowledge was greatest.

Cannon has recently summarized the best-known features of wound shock as characterized by a low venous pressure; a low or falling arterial pressure; a rapid, thready pulse; a diminished blood volume; a normal or increased erythrocyte count and hemoglobin percentage in peripheral blood; a leukocytosis; an increased blood-nitrogen; a reduced blood-alkali content, a lowered metabolism; a subnormal temperature; a cold skin, moist with sweat; a pallid, grayish or slightly cyanotic appearance; thirst; rapid respiration; often vomiting and restlessness; anxiety,

¹ Editorial, Journal of the American Medical Association, March 4, 1921.

² Archives of Surgery, July, 1921, **3**, 116; *ibid.*, January, 1922, **4**, 130.

³ Editorial, Journal of the American Medical Association, February 25, 1922, **78**, 585.

⁴ *Ibid.*, February 25, 1922.

changing to mental dulness and lessened sensitivity. Many of these features, he adds, may appear at once, or as soon after the reception of the wound as the observations can be made; or they may develop only after the lapse of several hours. At one time it was urged that the widespread effect in the organism induced by severe trauma might be due to nervous impulses. Numerous investigations, however, have made such a theory untenable. It matters little for the outcome of the trauma whether the injured parts are denervated or not; in truth, there is no clearly demonstrable essential relation between the production of shock and an excessive stimulation of the central nervous system. Equally true is the now recognized fact that the low blood-pressure initiated by severe injury is not primarily due to a loss of vasomotor tone or any comparable sort of exhaustion. As Cannon has convincingly pointed out anew, if the blood-pressure resulting from local trauma is not due to loss of blood into the injured region, or to reflex vasodilation, or to depression or exhaustion of the vasoconstrictor center, or to fat emboli, or to acapnia, the connection between the local damage and the general bodily state may reasonably be looked for in the remaining great connecting system—the circulation.

In harmony with this conclusion, there has arisen a theory of a toxemic cause of wound shock, based on evidence for the existence of a toxic factor liberated in the injured tissues.

Experimenta' and Anatomo-pathologic Research. Cornioley and Kotzareff's¹ experiments regarding traumatic toxemia were carried out on rabbits and guinea-pigs. The results of seventeen experiments, which coincided in general with what is already known on the subject, are summarized as follows:

1. While a ligature remained in place above the crushing lesions, the general phenomena of traumatic toxemia remained slight or were absent.

2. When the ligature was suddenly removed after a period of a few hours, during which no general morbid phenomena were noted, the animal died very soon as the result of rapid absorption.

3. Amputation done immediately after a crushing injury and above the lesion saved the animal's life, and such animals did not at any time show symptoms of shock.

4. Intravenous or intraperitoneal injection of the sterilized and filtered product of muscle crushing caused death, and the same physiologic phenomena and macroscopic and microscopic lesions as those noted in animals with a crushing injury.

5. If a crushing injury was left exposed, the animal did not at any time show toxic phenomena, as the autolytic products were allowed to flow away. The fact that shock remained absent, although the open and non-dressed wound could easily have become infected, seems to prove that traumatic toxemia is not due to bacteria.

Striking analogies between the physiologic effects of certain occasional tissue components and the phenomena of surgical shock have

¹ Rev. de chir., Paris, 1921, 40, 1.

been presented by Dale and his associates in England. Poisonous protein derivatives, products of partial digestion, of bacterial action and tissue manipulation readily produce fall of blood-pressure attended with a series of changes, in which "dilatation of the capillaries and pooling of blood within them, poisoning of their endothelial walls so that they are abnormally permeable, escape of plasma through these walls into the tissue spaces, and consequent concentration of the corpuscles are the main features." Championing the importance of these features characteristic also of traumatic shock, Cannon has presented a convincing review of clinical, as well as purely experimental, evidence for traumatic toxemia, citing in particular the notable contributions of the French surgeon Quénu. They show, among other interesting observations, that anything which delays or checks absorption from the injured region delays the development of shock; but if there is a sudden removal of the check serious results follow.

If shock is actually the outcome of intoxication, presumably by protein derivatives set free from areas of tissue destruction, some of the manifestations of severe burns become more easy of interpretation. As Cannon concludes, in harmony with other experts in this field, the present conception seems to be that not only the shock following burns, but also the delayed shock consequent on severe trauma, are properly placed in the same category with other forms of general depression of bodily functions and defective circulation due to the setting free of toxic material.

In the development of our conception of the effects of extensive burns there has been an evolution of ideas similar to that which has occurred with regard to traumatic shock. Sonnenberg¹ and Virch² attributed death from burns to a reflex depression of the vasomotor tone. Modern studies—Becker Schnitz ("Klinische und chemische Beiträge zur Pathologie der Verbrennung")³ and Weiskotten ("Histopathology of Superficial Burns")⁴—have shown that there is, as in shock, a great increase in the number of erythrocytes, *i. e.*, concentration of the blood and an enormous mobilization of leukocytes. The suggestion of recent writers—Bardeen,⁵ Eyff,⁶ Pfeiffer⁷ and Vogt⁸—is that, here too, death, when delayed, is the outcome of an intoxication, probably by a protein derivative set free from the area of tissue destruction. The present conception seems to be that not only the shock following burns, but the delayed shock consequent on the severe trauma, is properly placed in the same category with other forms of general depression of bodily functions and defective circulation due to the setting free of toxic material in the body.

This similarity of the shock, which follows burns during the first

¹ Deutsch. Ztschr. f. Chir., 1877, **9**, 138.

² Arch. f. path. Anat., 1880, **80**, 381.

³ Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1919, **31**, 416.

⁴ Journal of the American Medical Association, January 25, 1919, **72**, 259.

⁵ Bulletin of the Johns Hopkins Hospital, 1898, **9**, 137.

⁶ Centralbl. f. d. Grenzgeb. d. Med. u. Chir., 1901, **4**, 128.

⁷ Virchows Arch. f. path. Anat., 1905, **180**, 367.

⁸ Ztschr. exper. Path. u. Pharm., 1912, **11**, 191.

twelve to twenty-four hours, to the phenomena seen during the same period after traumatic wounds of war was noted by Lee and Furness, and they developed a surgical treatment of burns comparable to the surgical treatment of traumatic wounds now universally accepted. This was first published in the *Therapeutic Gazette* in 1918, and reviewed in *PROGRESSIVE MEDICINE* in 1919.

Anesthetic Properties of Pure Ether. At least twice within the last few years it has been reported that pure ethyl ether is not an anesthetic, and that the physiologic action ordinarily attributed to this compound is due to impurities contained in the commercial material. According to Cotton,¹ carbon dioxide may be the active agent in some ethers; but this investigator reported that he had obtained the best results by the use of ether containing ethylene, and possibly another gas of unrecognized nature. According to Wallis and Hewer,² ketones are the most important impurities, though they state that the anesthetic action of ether is enhanced by treating it with carbon dioxide and ethylene. The lack of chemical details in the papers of Cotton and of Wallis and Hewer is unsatisfactory. The foregoing statements appeared to warrant further investigation, and Stehle³ found that pure ether, made by a clean-cut chemical reaction, which excludes almost completely any contamination with substances which have been claimed to be the real anesthetic agents of ordinary ether, possesses to the highest degree the anesthetic properties which have usually been attributed to it.

Oxygen Need during Anesthesia. Jones and McPeck⁴ have been experimenting on animals to determine the relative viability of the respiratory and cardiac systems under anesthesia, especially nitrous oxide oxygen. Nitrous oxide, although it supports combustion outside the body, acts like any other indifferent gas while in the tissues. The effect upon the central nervous system is due to the exclusion of oxygen, because if it were an indifferent gas no effects could be obtained with a 4 to 1 mixture, since atmospheric air is 4 parts nitrogen to 1 part oxygen. The effect of the gas on the body begins as a suboxy-genating process in the pulmonary circulation where, owing to the supply of oxygen being cut off, the venous blood of the artery passes unchanged into the minute radicals of the pulmonary veins, causing more or less stagnation, resulting in a general anoxemia that may quickly develop into asphyxia unless the gases are properly mixed. Toxic doses of nitrous oxide cause death by respiratory paralysis. Experimentally, this was shown to be the case; one heart continued to beat for over five minutes after the respirations had ceased.

To determine the ratio between the hemoglobin index and the oxygen need, guinea-pigs were confined in bell-jars and fed varying amounts of the gases. The animals' blood-pressure was reduced by aspirations of blood from the heart. The conclusions were that when there was a loss of 20 per cent of blood the amount of oxygen required

¹ Canadian Medical Association Journal, September, 1917, 7, 769.

² Lancet, June 4, 1921, 1, 1173.

³ Journal of the American Medical Association, 1922, 79, 375.

⁴ American Journal of Surgery, October, 1921, 35, 109.

was from two to three times greater than it was before exsanguination, and that after 25 per cent loss the oxygen requirement was five times greater than it had been before. Cannon made similar observations on shocked soldiers. Oxygen starvation means acidosis, the hemoglobin is low and final oxidation of the acid derivatives of metabolism is incomplete. Patients with cardio-renal changes are the most serious risks, since they demand more than the normal volume of oxygen in their tidal air, and slight degrees of asphyxia may produce a fatal increase in acidosis or a disastrous degree of heart strain.

Heat Losses of the Body Connected with Surgical Operations Under Ether Anesthesia. Corlette¹ compares the physical appearance of patients under ether with persons doing muscular work. He made an attempt to gain an approximate idea of the quantity of heat that may be lost by a patient under ether. In default of measurement, he assumed that a reasonable working approximation might be estimated from comparisons with work. The maximum possible heat loss per 1000 liters (expiratory measurement) for any respired atmosphere not below freezing-point is 29.07 calories. At 20° C. the maximum is 23.86 and the minimum 14.74 calories. The heat loss caused by the warming of the vapor of 100 cc of ether from 0° C. to 33° C. (the temperature of expired air) is only 0.9 calories. These figures are compared with the total heat loss of 273 calories per hour for a man at moderate work and 105 calories per hour for resting. Therefore the cooling effect of cold ether vapor being quite insignificant, it is not reasonable to regard it as a cause of ether pneumonia. No heat loss can occur by respiration if the air is saturated with moisture and warmed to 33° C., and a similar condition of the atmosphere also completely blocks heat loss from the skin. This indicates the way for control of heat loss from either channel. He presents convincing figures showing the great increase in heat loss from the skin that is induced by even a slight current in the atmosphere. For preventing heat loss the optimum condition of atmosphere for an operating room is one of comparative stillness and reasonably high moisture content and temperature. The forms of warmed ether apparatus in common use dry the air. The extra heat loss caused by respiration of dried air more than counterbalances the effect of warming, and moist air should therefore be used. Warmed blankets maintain near the skin a water-saturated atmosphere at tropical temperature, preventing evaporation. The stored heat in four large blankets taken together amounts to 13.6 calories for each 10° rise or fall of temperature. Much of the heat is wasted into the air of the room or into the mattress. Heat cannot be absorbed into the body from hot-water bottles; they can only block heat loss. Safe electric warmers, suitable for warming, can be contrived, and they could usefully replace hot-water bottles.

Death following Ethyl Chloride Inhalation Anesthesia. Recently, articles concerning this anesthesia have classified it as without danger for short periods or for the initial stage of an ether or chloroform anes-

¹ Medical Journal of Australia, August 13, 1921, 2, 115.

thesia. Renner reports a death in a soldier, aged twenty-five years, where 5 cc of ethyl chloride were used; and Hartlief, a sudden collapse and death of a woman, aged twenty-five years, after the inhalation of only 20 drops; and a second case in a man, aged forty-six years, after 40 drops. Jaeger¹ reports a healthy man, aged forty years, with a normal blood vascular system as determined by physical examination; there was a question of possible malignancy of a large chronic ulcer.

Local Anesthesia. The subject of local anesthesia receives more and more attention each year. The foreign literature for some time past has been filled with it, and their experience has been sufficient, and over a length of time, to develop the mortality and unpleasant complications which should not be overlooked.

BY-EFFECTS AND AFTER-EFFECTS OF LOCAL ANESTHESIA.² Wiedhopf remarks that the symptoms from mild and transient toxic action of procaine are generally overlooked, or are ascribed to the patient's nervousness. But absorption of the drug may induce vomiting, palpitation, dizziness and sweating or collapse, agitation or somnolence, or even death. Collapse has been exceptionally observed with simple nerve-blocking—as for a herniotomy—with lumbar, sacral, paravertebral or splanchnic regional anesthesia. Hartel has reported a case of syncope during anesthetization of the Gasserian ganglion. Epileptiform seizures after high sacral anesthesia have been reported by four surgeons, to a total of 12 cases. Wiedhopf's list of fatalities in connection with local anesthesia begins with 2 deaths at goiter operations under paravertebral and others under high sacral anesthesia—a total of 14 fatalities, for which the procaine seemed certainly responsible. The extreme vascularization of the extradural space provides a huge surface for absorption of a fluid injected. The high pressure required to force the anesthetic into the sacral canal might force it mechanically into the circulation. In many of the toxic cases reported, it is mentioned that blood had dripped from the needle, showing that a vessel had been pierced. This seems to have occurred more often with the sacral, paravertebral, splanchnic and trigeminal technics than with others. Absorption of the drug is more likely in loose and highly vascularized tissue; Lawen had toxic symptoms in 2 operations involving the anus.

Wiedhopf reviews further the articles that have been published relating to toxic after-effect, citing instances of necrosis of the skin with sacral anesthesia; transient blindness (2 cases) after trigeminal anesthesia; paralysis after blocking a plexus, or injury of pleura or lung (Cappelle's case of fatal injury of lung), pneumothorax, pleuritis, mediastinal emphysema or air embolism. With paravertebral anesthesia, injury of the vertebral artery, transient irritation of the vagus or sympathetic, paralysis or injury of the pleura or kidney. With blocking of the splanchnic nerve, injection of the fluid into a vein or injury of some organ. With nerve blocking in the thigh, injury of the femoral artery. No after-effects have been reported as following parasacral anesthesia. It is disappointing to find that local anesthesia has not reduced the after-pains from the operation itself.

¹ Zentralbl. f. Chir., July 30, 1921, **48**, 1073.

² Wiedhopf, O. (p. 392).

ACCIDENTS WITH SPINAL ANESTHESIA.¹ Hertz injects 0.25 cc of caffeine subcutaneously for prophylaxis after the injection of the anesthetic, and at the slightest sign of mydriasis, pallor or relaxation of the sphincters, he repeats the injection of caffeine. If the symptoms are grave, he injects the caffeine directly into the spinal canal and lowers the head. Artificial respiration keeps dogs alive during the syncope until the toxic drug is eliminated. This may require an hour or two, but then the dog comes to life again. All who have reported meningeal accidents have mentioned their actual mildness in marked contrast to their apparent gravity, ranging from a simple meningeal reaction to an aseptic puriform meningitis. Under an evacuating puncture and the ordinary measures, the cure was complete in a few days. Saline infusion combats the symptoms from hypotension, while hypertension yields to lumbar puncture. The pressure in both blood and fluid should be recorded.

INDICATIONS FOR SPINAL ANESTHESIA.² Gosset and Monod report that at the Salpêtrière, during 1921, ether was used for only 300 operations, nerve-blocking in 71, chloroform in 3 and spinal anesthesia in 442 cases. Spinal anesthesia is reliable for operations below the thorax, and they have never had a fatality in more than 2000 applications of it. The headache with it is sometimes annoying and persisting; syphilitics seem particularly liable to this. It is particularly advantageous for the elderly, but they reject it for tuberculous subjects and where there is already a low blood-pressure and temperature. They had 2 fatalities where ether was given to supplement the defective anesthesia.

Preoperative Care. In acute surgery, water, according to Crile,³ is perhaps our most potent therapeutic agent, for water has a greater specific heat than any other substance; water has the greatest solvent power; water has the greatest power as a catalyst; water is the only medium in which colloidal systems can be established; water itself is a chemical activator.

It follows that water is a primary essential to the organism.

The well-being of the organism, as a whole, depends upon the state of its constituent cells; the state of the constituent cells depends upon the maintenance of their respiration; the maintenance of internal respiration of the cells depends upon the preservation of the acid-alkali balance and the resultant difference in potential between the nucleus and the cell body, and upon the degree of permeability of the selective semipermeable membranes of the cells. The maintenance of the essential properties of the cells—the preservation of their internal respiration—demands a medium with the qualities listed above, that is, water—fresh water.

We are prone to forget that man is a multiple descendant of his ancestral water-born unicellular marine organism; that man has emerged through evolution from the sea, bearing the formula of the sea, and that some parts of his body are almost as liquid as the sea; that he is a landed marine animal, obeying the laws of the sea.

¹ Herts, J. (p. 214).

² Paris médicale, March 11, 1922, No. 10.

³ Editorial, Surgery, Gynecology and Obstetrics, 1922, 34, 277.

Water, therefore, is the vehicle in which the mechanism of man is suspended, and without fresh water it cannot exist.

It follows that a patient should have water at every stage of his progress. He should have it early before the progress of the disease, or the trauma of operation may have disturbed the internal respiration of the cells. To assure the efficient watering of the cells, water should be given by each and every route that will assure its reaching the cells—by mouth, by rectum, by hypodermoclysis; in sufficient quantities—2000, 3000 and 4000 cc each twenty-four hours—and continued day after day until recovery or death.

If the patient cannot receive water, if his tissues fail to absorb and use water, it does not mean that water has failed; it is a sign rather that the organism has failed, and that irrevocable dissolution is in progress.

Water early, water continuously, water late—water—fresh water always—is a fundamental requirement of restoration and of conservation of the mechanism.

Postoperative Complications. Postoperative complications receive more than their usual share of this year's literature. Acidosis still is under discussion.

Ross¹ states that following the adoption of a more liberal diet before operation, elimination of the purgative and the earlier and more generous postoperative feeding, the number of cases showing postoperative acetone and diacetic acid in the urine has decreased. This agrees with our clinical experience.

Vaughan and Van Dyke have published a timely paper upon postoperative therapy, and we feel that it is of such importance that it is quoted freely.

POSTOPERATIVE DIETOTHERAPY. Vaughan and Van Dyke² state that prior to the middle of the nineteenth century the dietetic treatment of most acute disease conditions consisted in virtual starvation. Graves, in 1848, first insisted that a fever patient should be fed. Today clinicians are in accord regarding dietary treatment of febrile conditions. The high calorie treatment of typhoid fever is a more recent development, but its value has been demonstrated beyond cavil.

The surgeon notoriously pays less attention to dietary treatment than does the internist. In many surgical clinics postoperative treatment still consists in partial starvation. The desire to prevent nausea and vomiting results in undue caution.

The treatment of operative cases begins before operation. It is frequently advisable to keep the patient in bed for some days prior to operation, in order to build up the general resistance. A light, highly nourishing diet, relatively rich in carbohydrates, may be given up through the day preceding operation.

The importance of a liberal fluid intake before operation cannot be overemphasized. The prevention of shock depends, in part at least, on the maintenance of a normal blood volume. The practice still

¹ American Journal of Surgery, October, 1921, **35**, 121.

² American Journal of the Medical Sciences, 1922, **163**, 272.

occasionally in vogue of withholding fluids for some hours previous to operation results in preliminary dehydration, and renders the body less able to combat shock when it occurs.

Following operation, the patient usually receives nothing by mouth during the first twenty-four hours. During this period the stomach is usually upset, and there is a strong tendency to nausea and vomiting. If these symptoms are absent, there is no reason for protracted withholding of food. The administration of fairly abundant fluids before operation frequently lessens the tendency to nausea and vomiting. Another precaution, which is frequently successful, is that of washing out the stomach while the patient is still under the influence of the anesthetic. As soon as the stomach will tolerate ingested material, fluids may be administered. It is best first to try out the patient with water or with weak tea, or, if stimulation is necessary, strong coffee. Usually by the second day the patient is in condition to take liquid nourishment. Sometimes this occurs sooner.

The liquid dietary used in most surgical clinics, and also in many even of the more progressive medical clinics, is based upon two essential food substances: Milk and raw eggs in the form of egg-white, albumen or eggnog. Milk is frequently contraindicated in postoperative conditions because of the tendency to distention, and therefore albumen water is often the chief constituent of liquid diets. Scarcely any food substance is less fitted to be the principle article of diet than is uncooked egg-white.

The popularity of this article in treatment arose from the classic work of Beaumont, who found that raw egg-white left the stomach more rapidly than did any other food, and concluded that it was more rapidly digested. Little attention has been paid to more recent work demonstrating that this rapid emptying occurs because raw egg-white is not digested at all in the stomach.

They sum up the case against uncooked egg albumen in saying: (1) That it is very poorly digested and absorbed; (2) that as high as 50 per cent is lost in the feces; (3) that it tends to produce gastro-intestinal upsets; (4) that at times it appears to produce an albuminuria, a condition certainly not to be desired in postoperative cases in which the kidneys already are overworked, as evidenced by the frequency of albuminuria following general anesthetization. All of these disadvantages are eliminated by the simple process of coagulation.

While egg-white is principally protein, the preponderating element in the food of postoperative cases should be carbohydrate. During operation the metabolism is usually increased and the reserve supply of carbohydrate in the body is, to some extent, depleted. Carbohydrate should now be administered to furnish additional energy and to protect the patient's own body protein. If protein alone is given, the basal metabolism increases as a result of the specific dynamic action of protein. Protein so stimulates the metabolism that the rate of heat formation in the body is accelerated. Sugars and fats have a similar dynamic action, but to a much less marked degree.

Most patients, after undergoing an operation and postoperative treat-

ment, leave the hospital weighing decidedly less than upon entry. It seems reasonable to hope that under proper dietary care these patients may do equally well as those treated by high-calorie, high-carbohydrate diets in typhoid fever, and that individuals may leave the hospital weighing as much as, or more than, upon entrance. If this is to be attained it can best be done by feeding diets of relatively high caloric value and relatively high in carbohydrates.

It is, nevertheless, essential that sufficient protein be administered to repair the waste and loss of protein from the body tissues. Chittenden has shown that with slightly less than 1 gm. of protein per kilogram of body weight the amino-acid requirements of the tissues will be safely met. The average adult individual weighs about 70 kg. With 1 gm. of protein necessary per kilogram of body weight the daily diet should then contain approximately 70 gm. of protein. This will contribute about 280 calories to the daily requirement, and we must rely upon carbohydrates and fat for the balance. It makes little difference which of these two latter substances preponderates as long as the fat does not furnish more than 90 per cent of the non-protein calories. In view of the tendency to acidosis in postoperative cases, as indicated by the presence of acetone in the urine, it would appear more rational to utilize carbohydrates in preference to fats.

Different proteins vary greatly in their ability to maintain nitrogenous equilibrium. This is because certain ones, such as those from cereals, are deficient in one or more of the essential amino-acids. Van Slyke remarks that a man who might be kept in equilibrium on 4 gm. of nitrogen per day, in the form of beef, milk or eggs, would require 8 gm. as bread or potatoes and 16 gm. as beans. Thus, it would appear advisable, when we are giving proteins, to give those of higher value, such as meat or meat derivatives, milk, eggs and fish. We must differentiate between proteins of good quality and those of poor quality.

It is not enough that a diet possesses sufficient calories and is composed of the right proportion of foodstuffs. Sufficient vitamins must be present. The food must be palatable. There must be sufficient variation so that the diet will not become irksome. The food must be so prepared that it is easily digested and absorbed.

The physical texture and the fineness of division are factors worthy of consideration. In general, the more finely divided the food, the more rapidly does the digestive juice penetrate, and the more rapidly does digestion take place. Indigestible solids not only act as stimulants to peristalsis, but apparently actually retard normal absorption. The method of cooking is important. Fried substances are covered by a layer of material which the gastric juice can neither readily dissolve nor penetrate.

If the diet contains a fairly abundant proportion of milk and of eggs, whose albumen has been coagulated, there is little danger of deficiency in vitamins, either in the fat-soluble A or in the water-soluble B.

Palatability depends on: (1) Variation and (2) the type of food administered. Only two food substances are naturally appetizing and

do not require seasoning. These are animal foods and fruits. The use of fruit juices for increasing palatability is well known. The addition of meat extracts for the same purpose may be employed.

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ACUTE DILATATION OF THE STOMACH AS A POSTOPERATIVE CONDITION is carefully reviewed this year by Wilensky,¹ and was considered at length in our review in 1921.

The increasing references in literature we feel are a sign of its more frequent recognition, rather than increased incidence. But as yet the hospital surgeons see no evidence in their interne physicians that the importance and symptoms of the condition are being taught in the medical schools.

Neiden² states that to date no one has succeeded in reproducing acute paralysis of the stomach in animals, although severing the vagus on both sides below the diaphragm is followed by stretching of the fundus of the stomach and retarding its evacuation.

The mortality in the latest series published keeps as high as ever, as is seen by his tabulation of the cases published since 1911, 50 per cent of the 36 cases terminating fatally. In 46.2 per cent of the fatal cases the acute paralysis of the stomach was a postoperative complication.

One important practical conclusion from his research is the warning of the danger of morphine in postoperative stomach disturbances and in acute paralysis of the stomach. Morphine promotes secretion in the stomach in addition to its other action, and hence it adds to the load the stomach is already carrying.

This is an interesting observation for several of the assistants working with two surgeons, one routinely using morphine pre- and postoperatively and the other avoiding it before operation and allowing it sparingly after, have remarked that acute dilatation of the stomach occurs more frequently when morphine is used.

As to the *treatment*, only two courses are followed at the present time: Posture and gastric lavage.

During the last year we have successfully employed the duodenal tube instead of the dreaded stomach tube and feel that it is a decided advance. It is easily introduced, even in young children, and can

¹ PROGRESSIVE MEDICINE, June, 1922, p. 76.

² Arch. f. klin. Chir., Berlin, November 17, 1921, No. 2, **117**, 338.

be allowed to remain for three to six hours if necessary. Thus a continuous drainage or syphonage can be obtained instead of the intermittent lavage of the stomach tube.

The suggestion of Cutler and Hunt, which we discussed last year, that postoperative pulmonary complications are in the majority of cases due to embolism from the operative field, is receiving more favorable consideration.

POSTOPERATIVE LUNG AFFECTIONS AND THEIR PREVENTION. In preantiseptic days, elevation of temperature occurring after operations was considered to be due to the healing processes of the wounds. Today, while operative methods exclude the possibilities of wound infection more and more, considerable attention is devoted to the postoperative lung complications. Nandl,¹ from a study of the material from Hochenegg's Clinic, in Vienna, found a rather interesting difference between the frequency of the lung complications in patients operated on under general and under local anesthesia. Lung complications after goiter operation were less frequent when local anesthesia was employed. The method of anesthesia had no effect upon the operative results of hernia operation, and in stomach operations more depended upon the operation than upon the method of anesthesia.

The occurrence of lung complications after resections was more frequent than after gastro-entero-anastomosis. The incidence of lung complications appears to be almost the same in local and general anesthesia; however, fatal postoperative involvements were less frequent following local than following general anesthesia.

The possibility of postoperative lung complications decreased with the increasing distance of the operative field from the diaphragm. In 1379 cases of hernia and abdominal operations, postoperative lung complications occurred in 14.5 per cent; in 1585 cases of operations on the head, neck or buccal cavity, extremities, breast and rectum; the occurrence of postoperative lung complications was only 8.5 per cent.

Norris² reports a survey of 56,000 operations: 40,000 general operations showed a pneumonia morbidity of 1.1 per cent and a mortality of 0.4 per cent, while in 16,000 abdominal cases the pneumonia morbidity was 4 per cent.

We have noted in the past the higher rate of complications reported in the foreign literature than in the American.

POSTOPERATIVE MASSIVE COLLAPSE OF THE LUNGS. Hirschboeck³ calls attention to the subject of massive collapse of the lungs as a postoperative complication having scarce mention in American medical literature up to the present time, and only by English and Canadian authors. He believes that it undoubtedly occurs very commonly both in civil and military practice, and is frequently confused with other more or less common postoperative pulmonary complications, such as pneumonia, pleuritis, pleural effusions, etc.

Attention was first drawn to the occurrence of massive collapse of

¹ Deutsch. Ztschr. f. Chir., July, 1921, Nos. 1-2, 165, 67.

² Illinois Medical Journal, October, 1921, 40, 288.

³ Surgery, Gynecology and Obstetrics, 1922, vol. 67.

the lungs by W. Pasteur,¹ who cited 34 cases as occurring with postdiphtheritic paralysis of the diaphragm or other accessory respiratory muscles in 1890. It is interesting to note that Pearson-Irvine, in 1876, made the observation on cases which undoubtedly were cases of massive collapse, "That the physical changes observed in the lungs were the result of paralysis of the muscles concerned in the elevation and expansion of those parts." In a later series of 64 cases of postdiphtheritic phrenic paralysis, with 15 fatal results and with autopsies on 8 of these, Pasteur was able to demonstrate the gross pathology in 5, the others proving to be cases of bronchopneumonia. The cases were all bilateral, in a more or less advanced collapse, and all presenting the same characteristic *en grosse*, the parts being entirely devoid of air, of a deep, definitely circumscribed blue color and sinking entirely in water. Pasteur noticed the similarity in the symptomatology between numerous clinical cases developing postoperatively and these cases of postdiphtheritic paralysis with collapse of the lung. In 1908, in the Bradshaw lecture before the Royal College of Physicians, he drew attention to the condition, since which time he has encountered an increasing number of these cases and a corresponding diminution in those of postoperative pneumonia. The clinical features were accurately described, the diagnosis elaborated and in 1914² he published an article drawing attention to its frequency. Of 201 lung complications out of 3559 cases, in the Middlesex Hospital between 1906 and 1910, he found 12 cases of massive collapse, with 1 death; in frequency, less than pneumonia, bronchitis or dry pleurisy, but more common than embolism, abscess or pleural effusion. It was found to occur with all methods of anesthesia, and occurred following operations on all areas of the abdomen.

About the same time Pasteur wrote his contribution in 1914, Dingley and Elliott published an article³, inspired by Sir Rickman Godlee, who showed them several cases encountered in his practice. During a period of two years the writers observed 11 cases, all of which followed abdominal operations. Their contributions to the literature is noteworthy chiefly on account of their consideration of the possible cause of this condition. They recalled Lichtheim's⁴ observations, made in 1878, in which he had produced a condition similar in rabbits by introducing laminaria plugs into the bronchi, resulting in a collapse of the lung tributary to the bronchus, which was the subject of the experiment. Dingley and Elliott conclude that in man, in addition to the comparative immobility of the thoracic wall, secretion blocks the smaller bronchioles, with the result that collapse ensues, just as in Lichtheim's animal experiments. Pasteur postulated an active collapse of the lungs, with an absence of any obstruction to the air passages, which he thought was induced by reflex inhibition of the diaphragm. He believed the collapse, to put it simply, to be due to alveolar expulsion rather than alveolar absorption.

¹ International Journal of Medical Science, 1890.

² British Journal of Surgery, 1914, vol. 1.

³ Lancet, London, May, 1914.

⁴ Arch. f. exper. Path. u. Pharm., 10, 54.

Rose Bradford¹ devotes a chapter to the consideration of this subject in a recent "System of Medicine," in which he refers largely to previous articles written by him² in 1918-1919. His experience was largely with military practice, with a large incidence, particularly in gunshot wounds of the chest, in which injuries he believes it occurs in 5 to 10 per cent of the cases. He points out that in gunshot wounds of the head or arms massive collapse has not been known to occur, but is occasionally seen as a complication in wounds of the buttocks, pelvis and thighs, assuming therefrom that the degree of immobilization is a factor in its production.

Briscoe,³ in 1920, emphasized the effect of deficient respiratory excursion and a recumbent posture in causing diaphragmatic fixation with pleuritis and coincidentally pulmonary deflation.

Recently, Seringer,⁴ in his article speculates on the various theories heretofore promulgated regarding the causation of massive collapse, and adds his belief that the lesion is probably due to an abdominal interference with the vagus control, causing a contraction of the muscular elements of the lung, aided by the subsequent collection of mucus in the bronchi sufficient to prevent the egress of air and leading to absorption of the alveolar air content and ultimately collapse. His article is interesting, particularly on account of the roentgenographic studies, which in some of his cases show most extravagant alterations in the relationship between the intrathoracic organs.

Hirschboeck believes that various factors may produce the lesion and that they are probably never entirely single, except in postdiphtheritic paralyses, in which the immobility of the diaphragm is so extreme as to be strikingly conclusive as to its being the cause. One must bear in mind that on the one hand Lichtheim's experiments are difficult to refute with his careful experimental technic, whereas on the other hand the evidence offered by postdiphtheritic phrenic paralysis is equally incontrovertible. There is no doubt that the recumbent position, as emphasized by Rose Bradford and Briscoe, is an important subsidiary factor as well as deficient aëration of the lungs. It is probable that in civil practice the incidence is more common in abdominal surgery, leading to more or less fixation of the diaphragm, due to a reflex inhibition, with an effort to cause a splinting action on account of the neighboring trauma. The theory that the recumbent posture is a factor is corroborated by the non-occurrence of massive collapse in injuries not requiring immobilization of the body, such as injuries to the head and arms, as observed by Rose Bradford. The admonition to take deep-breathing exercises systematically after operations would not only promote aëration of the more distal parts of the bronchial tree, but would also tend to reduce the immobility of the perithoracic musculature. I think it reasonable to assume that, with the lack of mobility in the accessory muscles of respiration and the diaphragm,

¹ Oxford Loose-leaf Medicine.

² Quarterly Journal of Medicine, 1918-1919.

³ Ibid., 1920.

⁴ Surgery, Gynecology and Obstetrics, 1922, No. 6, vol. 32.

pulmonary expansion and retraction are necessarily limited. Mucus is formed and not expelled, causing an obstacle to the ingress of air into the smaller bronchioles, leading to ultimate alveolar absorption of the air into the circulation.

Bronchial obstruction, therefore, and muscular immobility tend to bring about this condition, one factor or the other predominating, however, in individual cases, leading to alveolar absorption, and finally to the condition of massive collapse.

The extent and the site of involvement in massive collapse vary considerably. In most cases there is only a partial involvement of one of the lower lobes of the lungs; in others the condition is more extensive, involving a whole lobe or even an entire side. It is rather frequently bilateral. The noteworthy feature is the fact that, in unilateral trauma, collapse occurs not only on the side affected, but oftentimes on the contralateral side, as was pointed out by Rose Bradford and others.

Physical Signs and Symptoms. The physical signs and symptoms of massive collapse are so distinctive that it is curious that the condition has not been recognized more commonly and described more frequently. A careful study of the case will make differentiation from conditions simulating it very easy. The exciting factor varies a great deal and any trauma, either accidental or otherwise, necessitating more or less immobilization of the body may bring about the condition. It has been known to follow all methods of anesthesia, has occurred with local anesthesia and without any anesthesia at all. Aside from military practice, I believe that in civil life it will be found that abdominal operation is the most frequent cause of the condition, on account of its immediate effect in requiring immobilization, producing immobility of the diaphragm and deficient aëration of the lungs. The condition may develop within a few hours or as late as one week after the exciting trauma. The onset is sudden, the course either rapid or at times protracted and resolution either prompt or slow. The degree of temperature is usually very moderate, but may be as high as 103° or 104° F., the coincidence of inflammatory phenomena probably influencing the height of the temperature curve. The respiration rate is increased by the immobility of the affected part, by an accompanying pleuritis or by toxic conditions incident to inflammatory complication. The pulse-rate is found to be more or less in direct relationship with the respiratory and thermic changes, but is less marked in uncomplicated cases, as would be naturally inferred.

On examining the chest, one is impressed by the diminished or absent excursion of the chest wall over the affected area. The cardiac impulse is displaced toward the affected side, and is as marked in the left-sided cases as in those occurring on the right side, the apex having a tendency to tilt outward and upward, so that the apex-beat may be felt in the axilla. In right-sided affections the impulse may be felt at the tip of the sternum or to the right of it. These signs are corroborated by roentgenographic study, the heart retraction being most marked, the dome of the diaphragm ascending to an unusual degree and the pulmonary area appearing partially or totally collapsed. In bilateral

affections the displacement of the heart is absent, but the high position of the diaphragm and the collapse of the lungs are easily manifest. On palpation, the intercostal spaces on the affected side are found to be narrowed, leading to a relative approximation of the ribs. The percussion note over the affected area is dull and may approach flatness. Rose Bradford points out that in left-sided cases the lower part of the chest wall is highly resonant, due to the abnormally high level of the diaphragm, the liver interfering with this symptom in right-sided cases. Breath sounds and fremitus are usually increased, sometimes enormously so, but may be diminished or absent. The transmission of voice sounds may be so intense as to approach whispered pectoriloquy.

Bronchophony was present in all of my cases, and in no case was there diminution of the breath sounds or fremitus. No doubt the alteration in the transmission of sounds is due to the relative proximity of the affected area to sound-conducting bronchial tubules. Rales are usually absent in the early stages, but supervene as the case progresses, probably due to a bronchitis, resolution or an occasional pneumonia developing. In a great many cases a pleural friction rub is plainly audible. In the later stages of the condition, when expectoration is rather profuse and resolution occurs, rales are more frequent. As resolution occurs, the heart gradually returns to its original position, the lungs slowly expand and the diaphragmatic dome flattens out.

The extent of the symptoms and the ease of recognition depend, of course, upon the amount of lung tissue involved and as to whether the condition is unilateral or bilateral. It is readily understood also that the influence of the condition on the patient's economy is dependent largely upon complicating factors, as well as upon the extent of the lesion. Dyspnea may be moderate or extreme, as it usually is in bilateral cases. The cough is slight, as a rule, in the beginning, with a rather scant expectoration, but in the later stages it is accompanied by an expectoration of profuse mucopurulent sputum. My experience bears out the previous observation that the sputum is rarely, or never, bloody—an important consideration in the differentiation between pneumonia or infarct and collapse.

Bronchitis, pleurisy and pneumonia are recognized as complications. Effusion has been known to follow pleurisy. A differentiation must be made between pneumonia, hypostatic congestion of the lungs, embolus, infarct, pleuritis (with or without effusion), hemothorax and massive collapse. When one bears in mind the outstanding pathognomonic signs of massive collapse, confusion with other conditions is difficult. One must bear in mind that the affected side is retracted and does not expand with inspiration. The diaphragmatic and cardiac displacement is extreme and the general symptoms invariably less severe than with pneumonia or embolus. The very marked dullness, the extreme increase in the breath sounds (as usually noted), the scant expectoration, the comparative absence of constitutional signs in the non-occurrence of complications, accompanied by displacement of the heart and diaphragm and roentgenographic studies, easily established the diagnosis.

The prognosis is invariably good, but bilateral cases, or cases affect-

ing more than one lobe, are more apt to be fatal, particularly in debilitated subjects.

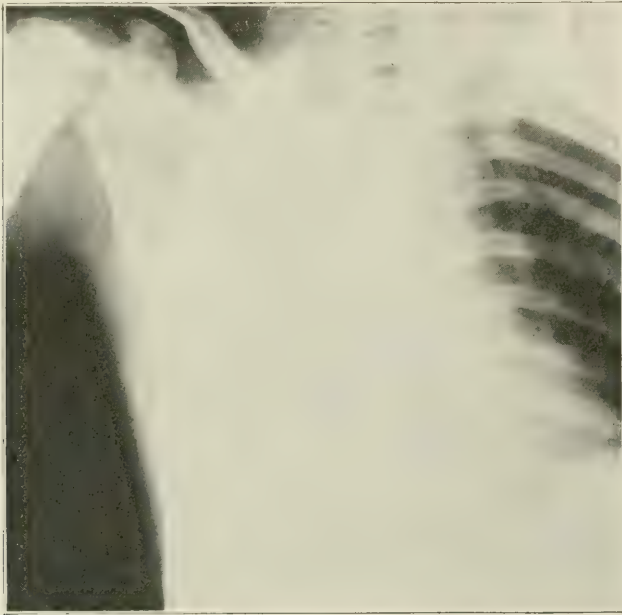


FIG. 10.—Appearance of chest, April 11. (Elwyn and Girsdansky.)

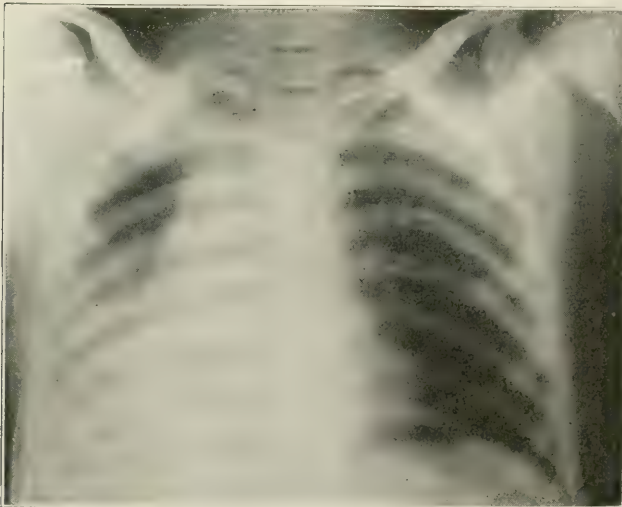


FIG. 11.—Condition, April 19. (Elwyn and Girsdansky.)

Elwyn and Girsdansky¹ report a case of postoperative massive collapse of the lung.

¹ Journal of the American Medical Association, August 26, 1922, No. 9, vol. 79.

This case undoubtedly represents one of massive collapse of the right lung, following a stab wound in the abdomen. What part the wound itself and what part the anesthesia played in the production of the collapse cannot be determined.

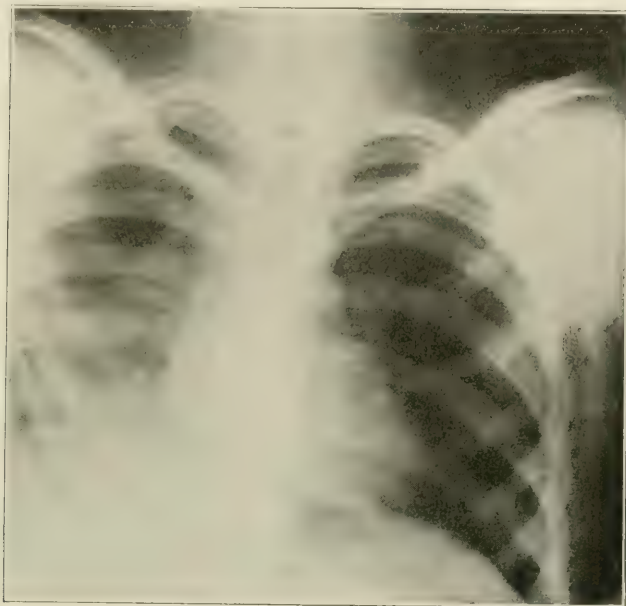


FIG. 12.—Appearance, April 26. (Elwyn and Girsdansky.)

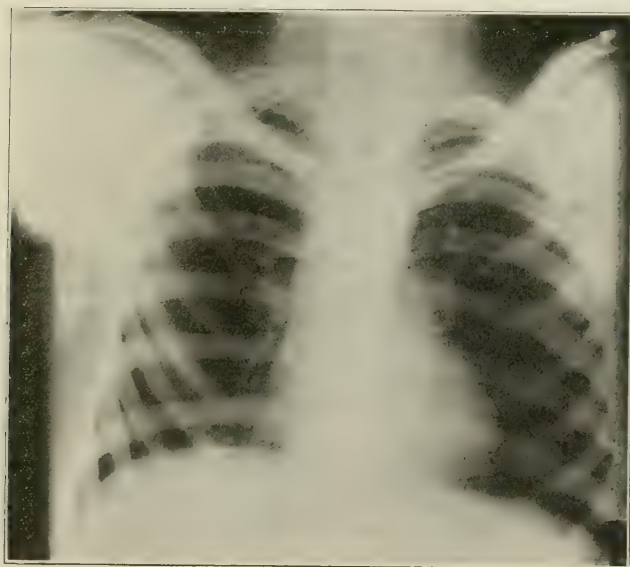


FIG. 13.—Normal appearance, May 10. (Elwyn and Girsdansky.)

POSTOPERATIVE THROMBOSIS AND LUNG EMBOLI. That thrombosis may be due to a predisposition of some sort on the part of the patient, and not upon some postoperative phase of convalescence, is suggested to Rupp¹ from the examination of the thrombi found in 13,000 cadavers dead of internal diseases. The factors governing thrombosis, such as slowing of the blood stream from changes in the blood as well as in the bloodvessel walls themselves, injuries to the intima and action of ferments upon the blood are common to all cases. Von Zurihelle states the collection of blood platelets behind the flaps of the valves of the larger veins in regions where, for mechanical reasons, the blood stream is slower, is the exciting factor.

Changes in the intima Rupp considers important because of the absence of thrombosis in severe cases of arteriosclerosis where the lining membrane is much altered. The blood platelets are the real etiologic factor and in recent thrombi, free from fibrin, they compose most of the structure, the red distal ends of the thrombus being due to stagnation of the blood with resultant coagulation. Rupp claims the changes in the blood due to infection have no influence on thrombosis. The agglutination of the blood platelets is due to chemical factors, and if this agglutination is prevented by the administration of hirudin, or similar substances, no thrombosis will occur even if all other favorable factors are present. The circulation of blood is necessary to bring new blood platelets for the construction of the thrombus and, in contradiction to the present view, it is the fast blood stream, and not the sluggish one, which favors platelet thrombosis. Injury to the vessel wall heals by fibrin formation and the resulting thrombus is soft and made up of many red blood cells, while the thrombus which forms in the lumen is firmer and composed mostly of blood platelets. The mechanical theory of Aschoff explains many of the unknown factors of thrombosis, but the injury to the vessel walls is always a necessary factor, as well as changes in the consistency of the blood-stream. Slowing of the blood stream alone is not sufficient, otherwise we would expect thrombosis in small venuoles where the blood-pressure is lowest, and not in the larger veins where it is higher. The fatal thrombi are most frequently found in the veins of the thigh and pelvis. Changes in the blood stream, as it passes under the hypogastric artery, the sacrum and Poupart's ligament have, no doubt, much to do with the condition. Thrombosis in the thigh most commonly follows laparotomy and seldom from operation on the vessels themselves. The enforced quiet and costal breathing from the pain following abdominal operation deprives the blood stream of the great veins of much mechanical assistance in reaching the heart. Abnormal conditions in the heart, kidneys, bloodvessels and lungs predispose to the condition. Rupp was unable to demonstrate a predisposition from infection.

Among 13,000 autopsies there were 657 cases of emboli or lung infarcts, making 5 per cent of all cases. The number was equally distributed between men and women. Among 22,689 operations, 0.25

¹ Arch. f. klin. Chir., Berlin, March 21, 1921, 115, 672.

per cent died of thrombo-emboli; most cases occurred between the ages of fifty and seventy years; the emboli occurred most commonly during the first week; most often after abdominal section; and in the left femoral and iliac veins about four times more often than in any other locality. In a large number of cases other lesions of heart, kidney, lungs or bloodvessels were demonstrable. Of 53,000 cases of death from internal disease, 601, or 1 per cent, died of thrombo-emboli. The age at which most cases occurred was between sixty and seventy years, and about 18 per cent showed other pathologic lesions. Three hundred and forty cases occurred in the femoral veins, 264 of which were on the left side. The anesthetic seemed to have no effect upon the occurrence of thrombosis. Infection also is unimportant, as shown by the absence of an increased frequency of thrombosis in cases of acute appendicitis and incarcerated hernia when compared with non-infected cases. As preventive measures, massage of the arms and legs, saline infusions, lung gymnastics, heart stimulants and complete physical examination of the vital organs are recommended.

SECONDARY PAROTITIS. Lynn¹ states that this condition, while not particularly common, is of sufficient frequency and interest to merit an occasional study and review of the literature. It is a phenomenon which has been associated not only with surgical procedures but has been frequently met with when a strictly medical regimen has been carried out. In reviewing the literature, it is quite interesting to note the gradual elimination of factors formerly thought to play a part in the production of this condition, and at the present time its etiology seems unknown.

Pyemia, or embolism, has been discussed.

The duct-infection theory was first advanced, in 1889, by Hanau and Pillet. They were the first to suggest the possibility of infectious organisms traveling up the duct to the gland. To justify their opinion they called attention to the pathologic findings, namely, inflammation around the ducts and then spreading to the perilobular tissue; whereas, if due to emboli the inflammation would first appear perivascular. This was substantiated by the bacteriologic findings of Girode, who found the organism mostly occurring to be the staphylococcus, pneumococcus, pneumobacillus, typhoid bacillus, colon bacillus and the streptococcus in the order of their frequency.

In cases of gastric and duodenal ulcers, Hone and Barton attached more importance to antecedent hematemesis than oral starvation as a factor in the production of secondary parotitis. This might be likely only insofar as it leads to treatment by oral starvation, there being no evidence that parotitis depends on the occurrence in the parotid gland of thrombi, such as might be favored by a posthemorrhagic leukocytosis.

The parotid contains lymph glands, the other salivary glands do not. The presence of these favors the collection of infectious agents and the setting-up of an inflammatory process.

¹ Surgery, Gynecology and Obstetrics, March, 1922, No. 3, vol. 34.

Before dismissing the question of cause, there is one factor to which Deaver calls attention, namely, "traumatism—the result either of direct pressure on the parotid gland or the forcible manipulation of the jaw by the anesthetist." But how many times have we seen cases in which the administration of the anesthetic was difficult, and it was necessary forcibly to hold the jaw, and yet this condition did not develop; and again we have seen this condition arise after a perfectly smooth anesthetic. At the City Hospital, many of the patients were alcoholic, the anesthetic in a great many cases difficult, and the occurrence of this condition practically *nil*.

Inquiries made by Fisher show that traumatism of the bony or soft structures of the face have had little, or nothing, to do with the production of the condition. He says, "The results of such inquiries have been negligible as to infectious parotitis." Our experiences bear out this conclusion. If it has any bearing, it is only a minor role.

According to Blair, suppuration usually takes place in three or four days, all symptoms being increased. Dyball finds that 33.33 per cent of the cases are bilateral. When this condition is bilateral there is usually an interval of two days before its occurrence on the second side. The enclosure of the pus may rupture and the latter discharge through the external ear, or it may force its way to the sternocleidomastoid muscle and travel downward to the supraclavicular and mediastinal regions. Retropharyngeal abscesses have been known to form secondarily. The gland may become gangrenous.

Wagner claims that the mortality of these cases is 30 per cent.

Fenwick, in the treatment of ulcer by oral starvation, formerly had a large number of cases develop suppurative parotitis. He tried various mouth washes without success. He then resorted to the giving of agents that would promote salivary secretion, at the same time not stimulating peristalsis of the stomach or intestines. After trying this plan he treated more than 300 cases by rectal feeding without a case of parotitis. When the condition does arise, the use of ice is recommended (Blair); and when suppuration does occur, as it usually does in three or four days, radical treatment by the incision of Blair, Lilienthal or Cope are recommended.

In this, one should not wait for fluctuation, but he should be governed by the increase of symptoms.

CONCLUSIONS. 1. More attention should be paid to the condition of the mouths of our patients, before and after operation. Following operations, some mild salivary stimulant should be given to keep the ducts clean.

2. The reason the sublingual and submaxillary glands are practically immune is because they are mucous glands, mucin inhibiting bacterial growth.

3. Furthermore, the parotid is the only salivary gland containing lymph glands. These favor the collection of inflammatory agents.

4. There are two main sources of infection, *viz.*: (1) Through the blood or lymph stream; (2) by way of Stensen's duct.

5. It is Lynn's opinion that the infection of the parotid in these

cases herein reported were oral, in view of the fact that in every instance oral starvation was necessary for some days. Surgical treatment is justified if symptoms do not subside by the third or fourth day.

Periarterial Sympatheticus. This work of Leriche¹ has created a great deal of clinical interest among surgeons, and as we ourselves have had under observation 11 cases in the services of Gibbon and LeConte, at the Pennsylvania Hospital, Philadelphia, our interest in the subject is at least explainable. This communication was read by Leriche before the American Surgical Association.

The sympathetic nervous plexuses included in the external layer of bloodvessels seems to possess a real autonomy. The sympathetic study of the phenomena, which follow the excitation of normal arteries, reveals the existence of a very characteristic physiologic reaction which never fails. When the sheath of an artery is pinched, the vessel contracts, its pulse stops at once and its size diminishes. If the cellular layer of the vessel is excised, it will diminish to one-third or one-fourth

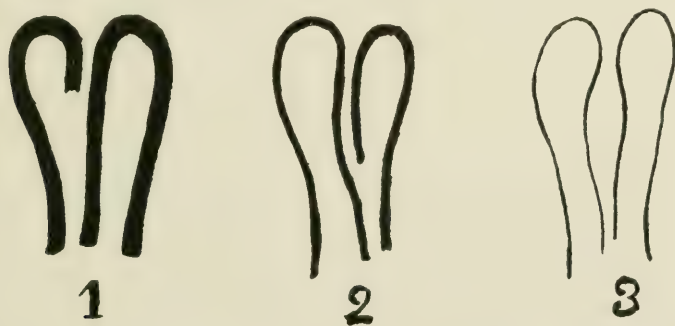


FIG. 14.—1, aspect of a normal capillary loop in a finger, examined by Weiss' method; 2, diminution of size when the brachial peri-arterial nerve is excited; 3, almost complete disappearance after ligature of the brachial artery. (Leriche.)

of its usual caliber. The segments on either side of the excision will maintain their normal size unless their sheath has been injured. This arterial contraction usually causes the pulse to disappear, but does not altogether interrupt the circulation. If the artery is cut through this contracted area, a thin thread of blood is seen inside, and, if the capillaries are examined by Weiss's method (Fig. 14) at the moment of arterial contraction, the capillary loops diminish regularly in their whole length, become pale, but remain visible. Thus, arterial contraction is the primary element of the usual physiologic reaction against excitation of the sympathetic nervous plexuses in the adventitial coat of the arteries. During the hours following the operation the limb is colder, and at times there is a difference of 3° to 4° C. After three to fifteen hours, definite changes occur, which Leriche calls the secondary symptoms. There is an elevation of the local temperature of the part reaching 2° and even 3° C., while the general body temperature is unmodified. The patient also has a

¹ Transactions of the American Surgical Association, 1921, **39**, 471.

subjective sensation of heat in the operative extremity. There is also an elevation in arterial pressure, which may reach 4 cm. of mercury, compared with the healthy side; this measurement of 4 cm. is found in the original article in the *Transactions of the American Surgical Association* and also in the reprint in the *Annals of Surgery* (we feel that he must mean mm.). The last phenomenon in the secondary signs is an increase in the amplitude of the oscillations, as shown by the sphygmomanometer. This vasodilatation reaction is transitional and it becomes attenuated from the fifth to the sixth day and disappears after three to four weeks. This concludes what Leriche calls the characteristic physiologic syndrome of periarterial sympatheticus against excitation.

Pathologically, such excitation may occur in visceral arteries as well as in arteries of the extremities, and may be produced by direct trauma or indirect infections of toxic agents. Whatever the cause, as soon as the periarterial sympatheticus is injured, the previously-described physiologic reaction occurs. As to the changes in the visceral blood-vessels, we know absolutely nothing of these reactions and they are at present time theoretical only. In the extremities he differentiates two groups of changes. In the first group the characteristic physiologic action is pure, while in the second group there are certain variations.

Group I includes two characteristic examples: "Stupeur des arteres" (the so-called causalgia of Weir Mitchell) and Raynaud's disease. "Stupeur," or causalgia, Leriche considers an active secondary spasm, due to sudden excitation of the adventitial arterial layer. It may follow a woundless traumatism as well as that of a projectile. Leriche feels sure that during the war this contracture was so intense in certain cases that it led to gangrene because of insufficient circulation. Undoubtedly, many unnecessary operations were done for this condition. Raynaud's syndrome is a typical disease of the vasomotor sympatheticus. In certain cases the periarterial sympatheticus of a whole limb seems to be excited, for the vascular contraction involves even capillaries. The crisis in Raynaud's disease consists in the physiologic reaction of the periarterial sympatheticus to excitation, namely, painful ischemia and consecutive dilatation.

In the second group the symptoms are not so clear-cut. In many instances the initial cause is left indefinite, and the physiologic action may consist of contracture of too long duration or of abnormally persistent dilatation. Thus motor, sensory, vasomotor, glandular and trophic symptoms may occur. Local necrosis and sloughs, profuse sweating or absolute dryness of the skin, cyanosis, local blue or white edema, pain and muscular atrophy, all of which Leriche feels can be explained by circulatory changes.

This leads Leriche to believe that the treatment of these vasomotor or trophic troubles must consist in the modification of the peripheral circulation by periarterial sympathectomy. The technic consists in the isolation of the artery for 8 to 10 cm., and then to dissect the adventitial sheath containing the sympathetic nerve trunks from the artery until it is completely denuded. He has performed the operation 64 times during the last five years.

1. In painful phenomena, as causalgia, he has 5 excellent results in 9 cases. He recommends that it be tried in the painful crises preceding the gangrene of obliterative endarteritis. It is in this type of case that it has been used at the Pennsylvania Hospital. In 2 cases of Raynaud's disease he obtained good results.

2. Abnormal muscular phenomena of the hypertonic type. In 18 contractures following war wounds all the cases were much improved. He warns against its use in what is called Volkmann's ischemic paralysis, which he considers a focal necrosis of the muscle and a definite lesion that nothing can modify.

3. In trophic disturbances leading to ulcers Leriche has found, perhaps, the best results. In 12 out of 13 cases the operation was followed by rapid healing, but relapse is possible if the cause of the trophic ulcer is not removed, and the cause is not always removed by a sympathectomy.

4. Leriche's explanation of the action of sympathectomy is that there is a local circulatory hyperactivity due to the vasodilatation.

A Case of Causalgia Treated by Decortication of the Artery. Turco¹ reports a man, aged forty-two years, who had attempted to commit suicide by cutting the radial artery. A year and a half later the patient returned because of intense pain. The hand was then swollen and it was almost impossible to move the fingers. The pulse at the wrist was weaker than that on the other side. As the symptoms were evidently sympathetic in origin, Leriche's operation was performed, the sheath of the artery being excised for a distance of 7 cm. Complete recovery from all symptoms resulted. This case, therefore, confirms Leriche's hypothesis.

Blood-pressure Findings in Circulatory Disorders of the Extremities. In an effort to arrive at a plausible explanation of certain circulatory disturbances of the lower extremities, whose origin and mode of production have been obscure, the blood-pressure findings of Bernheim² have not only been interesting, but may turn out to be of real significance. The gangrene and the near gangrene one sees nowadays are customarily differentiated into various groups—Raynaud's disease, arteriosclerosis, diabetes (with arteriosclerosis), senility, thrombo-angiitis, etc., according to such clinical manifestations and etiologic features as they exhibit. All of these conditions present many features in common; the treatment, for the most part, is as unsatisfactory and as unsystematized in the one as it is in the other, and the end-result is usually the same. As far as the patient is concerned, it matters little what group he falls in.

In all circulatory disorders of the extremities, a narrowing of blood-vessel lumens come to pass; gradually in most instances, suddenly in a few. It may be due to some spastic condition of the vessels that is at first of an intermittent character, but later becomes continuous, or, as is more usually the case, there is a gradual disposition of material from one cause or another in the wall of the vessel under the intima or within the lumen itself, which eventually totally occludes the vessel. In any case, an obstruction of varying degree is offered the flow of blood.

¹ Policlinica, Roma, 1921, **28**, 127, sec. chir.

² Journal of the American Medical Association, March 18, 1922, No. 11, vol. **78**.

This being the case, one of two things must occur: Either the amount of blood that passes the obstruction becomes less, or, if the volume is to remain as before, the pressure back of the stream must be raised.

Blood-pressure readings taken on patients suffering from a variety of circulatory disorders of the extremities indicate that, far from exhibiting a rise, many of them reveal a low pressure, extraordinarily low in certain instances, while most of them present a normal pressure. Once in a while a slight elevation is encountered. Almost never does one see a real hypertension. The surprising part of this is that it is just the opposite of what one might have expected, in view of the fact that a compensatory elevation of blood-pressure is frequently seen in generalized arteriosclerosis and in certain forms of heart and kidney disease.

The relation of these findings to ischemic conditions of the legs may be interpreted in two entirely different and distinct ways. It may be argued, on the one side that in circulatory derangements, exhibiting obstruction to the blood flowing toward the lower leg and foot, the blood-pressure does not rise, the *vis a tergo* fails to increase, and so no opposition is offered to the further encroachment of the disease process. The result—unless successful treatment is given—is gangrene. On the other hand, it is just as logical to suppose that in the vast majority of disease processes affecting the bloodvessels of the extremities there does occur a compensatory rise in blood-pressure and that, as a consequence, the threatened and real gangrenes do not come to pass. Only where this rise fails to materialize do we see the gangrenes. The latter theory might well account for our failure to find these disasters among the many hypertension victims. In my experience it is most unusual to see a gangrene, or even a threatened gangrene, in one of these patients. Bernheim suggested in the blood-pressure we may possibly have the explanation of certain obscure features connected with the production of the threatened and real gangrenes. Just why there should fail to be a rise in pressure in these cases is a mystery. It may not be logical to feel that it should come to pass, especially in a disorder that is, perhaps affecting but one limb. Nature does so much, though, that we are accustomed to expect the obvious thing from her at all times.

That a gradual narrowing bloodvessel lumen—whatever the cause may be—is aided and abetted on its course toward total occlusion by a thinned-out, slowed blood stream which has little or no force back of it, no one can deny. Little roughened plaques, tiny cracks in a stiffened intima, pin-point areas of disease, it does not require much of an imagination to see them picking out of the slowly passing stream first, perhaps, the platelets and then such other cell elements as may be needed to form the finally occluding thrombus. Nor is it difficult to understand why so many of these threatened gangrene patients have such a poor collateral circulation, if one will only realize that blind passages, collapsed tubes, can be opened up only by a blood flow of real force—such as they do not seem to have. It follows, then, that the blood-pressure element in all cases of threatened and real gangrene is apparently of more importance than has heretofore been recognized.

Obliterating Thrombo-angiitis. Gilbert and Coury¹ report a case which they claim is the first to be published in France and speak of it as "non-syphilitic arteritis obliterans of the Jews." They note that the affection seems to be restricted to the Jews from central Europe. In this case they amputated the foot. No reference whatever is made to the work of Leriche.

Large Mycotic Aneurysm of the Femoral Artery Developing During the Course of Subacute Infectious Endocarditis. Farley and Norris² place on record a large mycotic aneurysm of the femoral artery secondary to an infected embolus thrown off from the endocardium of a patient

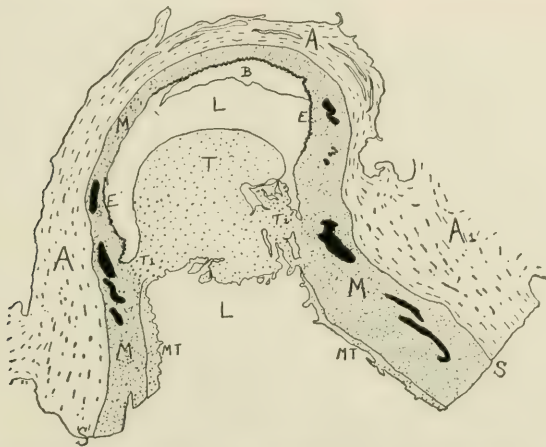


FIG. 15.—Diagrammatic camera lucida sketch $\times 30$ of a section across the lesion in the left femoral. The artery was split open and the edges of the split, *s* and *s*, spread wide apart in the hardening fluid. *L*, lumen. There is no intima. The heavy undulating lines, *e* and *e*, represent all that is still traceable of the elastica. The media, *m*, *m*, is thickened by connective-tissue growth and by round-cell infiltration. The solid patches in it are the foci of calcification of Moenckeberg's sclerosis. In places it lies naked to the blood current in the lumen, in places it is covered by elastica, in places it is overlain by thrombi, *mt*. The adventitia *a*, *a*, is normal. At *A*¹ it goes over into the sheath and adventitia of the femoral vein.

The large thrombus, *t*, is quite fibrous at its attachment *T*¹, soft, shaggy and infiltrated with pus, and round cells at its opposite attachment *T*².

The mural thrombi, *m t*, *m t*, probably lay close to or were continuous with the lower edge of the central thrombus before the vessel was opened, the larger portion of lumen and the more normal vessel wall lying above it (in the drawing). Some blood, *b*, settled on the vessel wall postmortem. (Floyd.)

suffering from subacute infectious endocarditis. The aneurysm developed while the patient was under observation and grew to such large proportions that spontaneous rupture was feared. In order to prevent this fatal event, obliterative aneurysmorrhaphy (Matas) was performed.

The patient presented a surgical problem at the time of the beginning of her femoral aneurysm. Tumor, dolor, calor and rubor were so marked that the question arose as to whether the lesion was an abscess, which should be incised, or merely an aneurysm. Fortunately, opera-

¹ Bulletins de la Société médicale des hôpitaux, Paris.

² Transactions of the Ayre Laboratory Bulletin, 1922.

tion was deferred, and the true character of the tumor had manifested itself when the case was first seen by the reviewer.

Aneurysmorrhaphy was done under local anesthesia, with digital compression of the artery above the site of dilatation. Seven days after operation a secondary hemorrhage occurred and the vessel was resutured. The death of the patient was caused by pyemia.

Floyd¹ reports a mycotic embolism of the femoral vessels, whose unusual features were: (1) The large size of the sac, its wide venous connection and the density of its walls, preventing its rupture and enabling it to erode bone. (2) The extensive lesion inside the opposite femoral, with ulceration and formation of an organizing thrombus, but without any aneurysmal dilatation. These features appear to depend, in part, on an infecting organism of low, but persistent, virulence, which allowed time for extensive connective-tissue growth and, in fact, may have stimulated it. This low virulence was evidenced by the long duration of the illness, the late appearance of cardiac symptoms, the character of the lesion in the muscle wall of the heart as well as of those in the right and left femoral arteries.

1. Rokitansky: *Handb. d. path. Anat.*, 1844, **2**, 553.

2. Tufnell, J.: Influence of Vegetations on Valves of the Heart in Production of Secondary Arterial Disease, *Dublin Quarterly Journal of Medical Sciences*, 1853, **15**, 371.

3. Ponfick: Ueber embolische Aneurysmen, nebst Bemerkungen über das acute Herzaneurysma Herzgeschwür), *Arch. f. path. Anat.*, Berlin, 1873, **58**, 528.

4. Thoma, R.: Ueber das Aneurysma, *Deutsch. med. Wehnschr.*, 1889, **15**, 309, 340, 361, 380.

5. Eppinger, H.: Pathogenesis (Histogenesis und Aetiologie) des Aneurysmen, einschliesslich des Aneurysma equi verminosum, *Arch. f. klin. Chir.*, 1887, vol. **35**.

6. Unger, W.: Beiträge zur Lehre von den Aneurysmen, *Beitr. z. path. Anat.*, 1911, **51**, 137.

7. Osler, W.: *Gulstonian Lectures*, 1885, **1**, 469.

8. McCrae, J.: A Case of Multiple Mycotic Aneurysms of the First Part of the aorta, *Jour. Path. and Bacteriol.*, 1905, **10**, 373.

9. Lewis, D., and Schragar, V. L.: Embolomycotic Aneurysms, *Journal of the American Medical Association*, 1909, **53**, 1808.

10. Simmonds: Mykotische Aneurysma der Aorta, *München. med. Wehnschr.*, 1904, **51**, 627.

11. Libman, E.: Embolic Aneurysms, *Mt. Sinai Hospital Report*, 1907, **5**, 481, 488.

Richey and MacLachlan² report 2 cases of mycotic emboli, one in the superior mesenteric and the other in the posterior tibial artery. Both were associated with a definite acute and subacute vegetative endocarditis of the mitral or aortic valves. In 1 case infarcts were found in the spleen and kidneys. *Streptococcus salivarius* was isolated from the blood streams of 1 case during life. No suggestion of syphilis was found in either case at necropsy. Both aneurysms had ruptured, at first slowly, with the formation of a false aneurysm. Clinically, the rupture of the aneurysms was characterized by severe, sudden, lancinating pain, which persisted. From the evidence, it would seem that both aneurysms had their beginning in an infected embolus.

¹ *Surgery, Gynecology and Obstetrics*, 1921, **33**, 560.

² *Archives of Internal Medicine*, January, 1922, No. 1, vol. **29**.

Operative Treatment of Femoral Thrombosis. Fasano¹ reports the exposure of the femoral artery 3 cm., below Poupart's ligament. This revealed an organized thrombus, compact and adherent to the vessel wall. It was forced out completely by manipulations, and the blood flowed at once. The artery was sutured. The pulse became perceptible in the foot; this did not last more than a day or two, but the pains subsided and have not returned during the ten months since; the gait is normal. The thrombosis evidently extended or reformed below the field of operation, but the removal of the accessible thrombus opened the passage into the deep collaterals. The circulation in these was enough to insure the nourishment of the tissues and check the tendency to gangrene.

Some years ago the reviewer assisted the late Francis T. Stewart in the removal of a thrombus lodged at the bifurcation of the left common femoral, with a result similar to that obtained by Fasano, a reformation of the thrombosis, and eventually it became necessary to amputate through the middle third of the leg.

Embolectomy in Treatment of Embolism of the Extremities. Rey² has compiled 45 cases of embolectomy, the operation being a success in 9 of the 12 cases with an interval of less than ten hours; in only 2 of the 5 with an interval of eleven to fifteen hours, and in 3 of 4 cases with intervals of from sixteen to twenty or twenty to twenty-four hours. As thrombosis develops below the obstruction so rapidly, the outcome depends usually on the promptness with which the embolus is removed. Secondary thrombi should be removed at the same time. After removing the embolus the clamp on the artery above should be loosened to allow the blood to sweep out any emboli from above. If, after suturing the vessel, the circulation is not restored through the limb search should be made for an embolus at some other point.

He reports 8 cases of embolectomy and 11 others done by other Norwegian or Swedish surgeons. The outcome was successful in 10. In the total 45 cases, the operation followed within twenty-four hours in 43 and the outcome was favorable in 11.

Emboli and Embolic Gangrene. Bull,³ in a total of 6140 necropsies, found evidence of embolism in the arm or leg in 15, but in 4 per cent of the total cadavers he found thrombosis in the aorta in 9 cases, and in the heart in 234. He concludes that embolism in a limb is usually merely one link in a chain of emboli in other organs, prior to, simultaneous with, or subsequent to, the embolism in the extremity. In his 15 cases of the latter embolism was manifest in the lungs (9), in kidneys (9), in spleen (7), in brain (4) and in the intestines (1) in all but one of the cadavers of this group. Among the 237 cases with thrombosis in the heart, embolism was found in all but 48. In 113 it was in the lungs; in 74 in the kidneys; in 60 in the spleen; in 32 in the brain; in 6 in the intestines; and also the 15 with embolism in the limbs; and the 1 case of embolism in the liver.

¹ Archivio Italiane de Chirurgia, Bologna, April, 1922, No. 2, vol. 5.

² Acta Chirurgica Scandinavica, Stockholm, January 17, 1922, No. 4, vol. 54.

³ Ibid.

Blood Transfusion in Severe Burns of Infants and Young Children. Bruce Robertson¹ accepts the pathologic explanation of shock in burns that is now being generally accepted, and which Lee and Furness presented in 1918. The primary shock, resulting from pain and undue radiation of the body heat, corresponds to primary wound shock encountered in all traumatism, depending upon the amount of dead tissue produced; a secondary or toxic wound shock appears in from twelve to twenty-four hours and the toxins of the burned tissues are thrown into the blood stream. This action decreases after three or four days if the patient survives. Robertson has been administering blood transfusion and in more serious cases bleeding followed by blood transfusion, and a series of 100 consecutive cases is discussed.

The Choice of Methods of Blood Transfusion.² In the early days of its modern clinical application blood transfusion was an exceedingly difficult procedure, involving an artery to vein operation with refined surgical technic. Gradually, the mode of introducing blood from donor to recipient has been simplified until at present the transfer can be carried out with far greater ease. Syringe and cannula methods have come into vogue and made transfusion easier, and hence available for many physicians instead of a few specialists. Of late the device of adding citrate to render blood incoagulable and keep it in this state for hours, so that it can be injected into patients at will, has been given favorable consideration in many quarters. The relatively simple procedure of citrate transfusion has been widely employed since the World War, and is today perhaps the method of election for most practitioners in most cases.

Those who are experienced in the work of blood transfusion realize that it is by no means an uncomplicated therapeutic measure. Objectionable reactions are experienced by many patients subjected to transfusion, and sometimes the results are so grave that the best of operators are seriously disturbed by the outlook. A few months ago Bernheim³ announced that, as a rule, in from 20 to 40 per cent of all citrate transfusions a reaction of greater or lesser severity will occur despite the various precautions that study of the technic has made imperative. On the other hand, after the more refined whole blood transfusions, the percentage of reactions is scarcely as high as 5.

These are facts which cannot be ignored, despite the operative difficulties presented in many cases by the demand for transfusion of unmodified blood. Unger⁴ has recently substantiated the difference between the two methods of transfusion referred to with respect to the frequency of chills, febrile reactions and evidences of shock. His investigations at the College of Physicians and Surgeons, New York, indicate that the unfavorable action of the anticoagulant sodium citrate is exerted directly in the cellular elements of the blood. As early as 1919 Drinker and Brittingham,⁵ of the Peter Bent Brigham Hospital,

¹ Canadian Medical Association Journal, October, 1921, **11**, 744.

² Editorial, Journal of the American Medical Association, No. 7, vol. **78**.

³ Journal of the American Medical Association, July 23, 1921, **77**, 275.

⁴ Ibid., December 31, 1921, **77**, 2107.

⁵ Archives of Internal Medicine, February, 1919, **23**, 133.

Boston, came to the conclusion that citration seems to harm red cells, and possible direct evidence of this exists in the occasional promotion of fragility by the citrate. The indication is that hemolysis contributes a certain number of reactions, although it is too slight to be detected by direct methods. A further cause of the objectionable reactions following transfusion of citrated blood has been sought in changes demonstrably occurring in the blood platelets after citration.

Unger has further contended that citrate not only affects the red blood cells so as to render them more fragile, but also alters some of the immunologic properties of the blood. Thus, it decreases the available quantity of complement, a vital factor in the defence of the organism against pathogenic microorganisms, in two ways: By its direct action on complement itself, and by introducing into plasma an anti-complementary substance which inactivates complement. This substance is derived directly from the bodies of red blood cells. According to Unger, sodium citrate also reduces almost to *nil* the function of opsonins, and practically destroys the phagocytic power of white blood cells.

Obviously, these newer facts present the shortcomings of transfusion with citrated blood in a light that further discloses unsuspected advantages in the use of unmodified blood from the biologic standpoint. The time has perhaps arrived when it is desirable to consider not only gross incompatibilities between the bloods of donors and recipients, as is now done in a routine way to avoid post-transfusion agglutination or hemolysis, but also the finer qualitative differences. Unger maintains that since complement and the phagocytic power are of prime importance in the protective action against pathogenic organisms, unmodified blood from a donor with high phagocytic index should be employed when attempting to combat local or general infections by means of transfusion.

The use of citrated blood has been attended with too many beneficent results, especially in emergency situations, to be summarily discarded for a procedure admittedly calling for professional skill not attained by most practitioners. It is generally known that the giving of whole blood requires constant practice and knowledge of surgical technic; hence this method of transfusion doubtless must remain in the hands of surgeons. The problem of the physician therefore consists in the ability to determine when the more difficult procedure is imperative. For diseases, Unger concludes, in which the transfer of blood is indicated for itself, that is, when it is required as a tissue—as in various anemias, blood diseases and infections—there can be no question as to the superiority of whole unmodified blood. In cases of hemorrhage, on the other hand, when the purpose is not so much to replace pathologic with normal blood as it is to replenish the impoverished circulation or to bring about cessation of hemorrhage, citrated blood may serve as a substitute. Here, as so often in practical medicine, the judgment of the physician must determine what course is most conducive to human welfare.

Factors in Reactions After Blood Transfusions. Butsch and Ashby¹ report 737 transfusions studied to find an explanation of the reaction. The sodium citrate method, used routinely in the Mayo Clinic, was employed, and a uniform technic was carried out.

The cause of reactions was approached from the points of technic, the factors intrinsic to the patient and the factors involving both the patient and the donor.

The omission of saline solution caused no decrease in the number of reactions. The washing of all utensils in strictly neutral water caused no improvement in the percentage of reactions. Neither did the treatment of new rubber tubing recommended by Stokes and Busman give results to indicate that such tubing had been an important factor in transfusion reactions. Desensitization of the patient was attempted by protracting the transfusion time to thirty minutes. In 4 patients thus treated, there were 2 severe reactions.

Certain points regarding the condition of the patient were then observed. It was found that the tendency to reaction was least when the initial temperature was normal and increased with an increase in the initial temperature. In 265 cases the hemoglobin percentages showed a definite relation to transfusion reactions, the lower percentages giving the greater number of reactions. This agrees with the reviewer's experience.

Types of Cases Unsuitable for Citrated Blood. Bernheim² publishes the following warning from his experience, that there are apparently two types of cases which should not be given citrated blood:

1. Cases in which there has been a hemorrhage of such intensity that the extreme limits of bleeding have been reached, and the patient is in such a state of shock that everything in the nature of additional shock must be avoided.

2. Those states of anemia, either primary or secondary, in which the blood depletion has progressed to such limits that the patient is almost dead.

Length of Life of Transfused Erythrocytes. Red blood corpuscles from donors in Group 4 transfused into patients in Group 2 with pernicious anemia secondary to nephritis, Wearn, Warren and Ames³ found, remained in the circulation longer than has been generally believed to be the case. The last of the transfused red blood cells disappeared from the circulation in from fifty-nine to one hundred and thirteen days, with an average of eighty-three days. No difference was noted in a series of observations in the duration of the stay of the transfused red blood corpuscles in the circulation between patients with primary anemia and secondary anemia (due to nephritis).

Reinfusion of Extravasated Blood. Rietz⁴ induced intra-abdominal hemorrhage on 7 dogs and then restored the extravasated blood to the blood stream. The intervals ranged from fifteen minutes to nineteen

¹ New York Medical Journal, 1921, **113**, 513.

² Journal of the American Medical Association, July 23, 1922.

³ Archives of Internal Medicine, April, 1922, No. 4, vol. **29**.

⁴ Lyon Chirurgical, January, 1922, No. 1.

hours. A form of soft coagulation occurred and the balance of the extravasated blood was so defibrinated that it did not coagulate on standing even for a week, or even when coagulating substances are added to it. The clots formed were small and soft, and contained relatively few blood corpuscles, showing the process differs somewhat from ordinary coagulation. The fluid blood has the aspect of normal blood, but its character is that of defibrinated blood, and thus it is adapted for infusion. This defibrination, Rietz suggests, is probably caused by the respiratory and peristaltic movements in the abdomen. The erythrocytes kept their normal color and shape for nineteen hours at least. Two of the dogs died after autotransfusion of blood before defibrination had occurred. Rietz accepts this explanation of the fatal outcome. Coagulation had not occurred, but was on the point of occurring, and it did occur after the extravasated blood had been infused, disturbing the colloidal balance in the blood stream, with fatal results. To avoid this, the extravasated blood must be examined and not used until coagulation no longer occurs. To insure greater safety, he advises citrating the blood to about 0.4 per 1000, and straining the blood through filter paper or a double-gauze compress. The risks of this autotransfusion seems to be greater the more intense the anemia.

Goder¹ has compiled 52 cases, in which the extravasated blood was infused, with recovery in all but 1 of the otherwise practically moribund patients. He reports a favorable case from his own experience, and commends the procedure as harmless and life-saving. Tubal abortion is generally the indication, but it has been applied with rupture of the spleen, of the liver, and gunshot wound of the spleen and of the lung.

Zimmerman² states that, from his experimental and clinical research, the peritoneum is able to resorb extravasated blood freely, and thus the erythrocytes and other elements in fluid blood in the absence of infection may return unharmed into the blood. We have referred to Sweet's similar statement last year. He advises, therefore, with a ruptured tubal pregnancy to clear out the clots, and leave to the natural forces the resorption of the fluid blood. This occurs so rapidly that the erythrocytes reach the blood in a still functionally capable condition. Only when the pulse is too weak and growing weaker, is it best, as a last resource, to retransfuse the blood to hasten matters.

Lohnberg³ advocates the complete removal of extravasated blood, and reports 14 cases, in which he reinfused the extravasated blood, injecting this between 500 and 1150 cc of blood. It was infused, still warm, after defibrination by stirring with a glass rod, using a glass cylinder, tube and porcelain funnel and filtering through eight layers of mull.

Intravenous Use of Acacia.⁴ The discussion by Bayliss,⁵ the originator of the intravenous use of acacia solution, will be appreciated by readers,

¹ Deutsch. Ztschr. f. Chir., April, 1922, Nos. 5-6, vol. 170.

² Ztschr. f. Geburtsh. u. Gynäk., November 12, 1921, No. 2, vol. 84.

³ Ibid.

⁴ Editorial, Journal of the American Medical Association, No. 10, 78, 730.

⁵ Journal of the American Medical Association, No. 24, 78.

although it is disappointing to learn that the main issues raised by the editorial, to which he replies, are not effectively disposed of by him, but are virtually left *in statu quo*. It is now generally accepted that acacia has a limited and uncertain usefulness, notwithstanding the impression conveyed by the author that the place of this substance in therapeutic armamentarium is assured, and that the mechanism of its action and other features are settled. That this is far from being the case can be readily ascertained from the papers quoted in the editorial and those on the mechanism of its action and usefulness recently published by Zondek¹ and Meyer.² Bearing in mind the accidents from the use of acacia that have been reported, the lack of agreement as to its beneficial effects, among surgeons who have tried it, the experimental evidence that has been reported as to its deleterious effects, and the paucity of data indicating its clinical usefulness, conservative practitioners will still withhold their verdict. Moreover, the questions of intravenous therapy, which are involved in any discussion on the use of acacia in shock, hemorrhage and allied conditions, are an important and serious complicating consideration.

Lee³ reports sudden death in 2 patients following intravenous injection of acacia.

Taken as a whole, the results obtained following the injection of acacia in these 2 patients give the impression that this agent is not entirely harmless.

Whether emboli, or thrombi, and agglutinated corpuscles occurred in these patients is not known. It would be useless to speculate further, but the dangers of intravenous medication are emphasized again, and these are not confined to acacia, whose role as a beneficial therapeutic agent in shock, hemorrhage and allied conditions, may, indeed, be questioned.

Intramuscular Administration of Sodium Citrate (A New Method for the Control of Bleeding). Upon the clinical application of the anti-coagulating action of sodium citrate to blood transfusion, in 1915, there immediately arose the question of the effect of sodium citrate on the coagulability of the recipient's blood. Would the introduction of sodium citrate, recognized as an anticoagulant, result in a suspension of coagulation in the recipient? That this did not occur was soon established; in fact, a transient shortening of the coagulation time in the recipient, with a subsequent return to the previous level, was found to follow the transfusion of citrated blood. In an effort to seek an explanation for this paradoxical action, some experiments were begun by Neuhof, in 1916, and again taken up, in 1919, by Neuhof and Hirshfeld.⁴

SUMMARY. 1. The administration of sodium citrate intramuscularly intravenously and subcutaneously, results in prompt and pronounced shortening of coagulation and bleeding time. This is a hitherto unrecognized pharmacologic action of the drug.

¹ Biochem. Ztschr., 1921, **116**, 246.

² Klin. Wehnschr., 1922, **1**, 1.

³ Journal of the American Medical Association, August 26, 1922, No. 9, vol. **79**.

⁴ Annals of Surgery, July, 1922, No. 1, vol. **76**.

2. The shortened coagulation time is of two to three hours' duration, with gradual return to the normal within twenty-four to forty-eight hours.

3. The sodium citrate curve occurs not only in individuals with normal coagulation and bleeding time, but also in those in whom there is a pathologic prolongation, notably in jaundice.

4. It does not occur in blood disease characterized by blood platelet deficiency—hemophilia and purpura. These diseases appear to comprise the sole contraindications to the use of sodium citrate for the control of bleeding.

5. The dose for intramuscular administration of sodium citrate is 9 gm. for adults. A 30 per cent solution is used, 15 cc in each buttock, preceded by novocaine. The intramuscular method is free from danger, no untoward results having been noted in 200 cases, and is therefore the method of choice.

Myositis Ossificans. Last year we reviewed an article by Painter on this subject. Three cases in our hospital work during the year and a fourth reported by Kessel¹ as "osteophytic ankylosis of the elbow" justify another reference to the subject.

Painter² found 339 cases. Any muscle may be affected, the most common being the brachialis anticus, quadriceps extensor, abductor longus and biceps of the upper arm, in this order. The authors believed such deposits to be caused in various ways, the majority being produced by osteogenesis of avulsed periosteum, which, when it has escaped into the muscles enveloping the bone from which the periosteum has been torn, continues to grow. A progressive type of the disease occurs in the young and extends through practically all the striated muscles of the body. A tendency to revert to an osseous condition by retrograde metaplastic reaction, inflammatory or katabolic, may explain ossification in muscle in individuals who have just enough of a tendency toward that type of katabolic transformation to react to the stimulus of a violent trauma. Other individuals have neither the progressive nor traumatic type, but, under slight, oft-repeated trauma, develop transformation in tendon sheaths and fascial attachments of certain muscles. A diathesis or dyscrasia, in varying degree, may underlie all types.

Our cases all involved the brachialis anticus and, after excision of the process, perfect functional results were obtained.

Kessel's case followed a trauma; it was diagnosed as a fracture, and treated for two or three months by massage and passive motion. The roentgen ray then taken (Fig. 16) was not diagnosed as myositis ossificans.

Myositis. From the results of an investigation of 28 cases of myositis at the Mayo Clinic and the findings in animals given injections of cultures made from material obtained, Rosenow and Ashby³ conclude that myositis, including even the mild, transient affections of muscles, is caused

¹ Annals of Surgery, 1922, p. 638.

² Boston Medical and Surgical Journal, July 14, 1921, 165, 45.

³ Focal Infection and Elective Localization in the Etiology of Myositis, Archives of Internal Medicine, 1921, 28, 274.

in the main by lodgment and growth of bacteria, usually streptococci, which have elective affinity for muscle tissue.

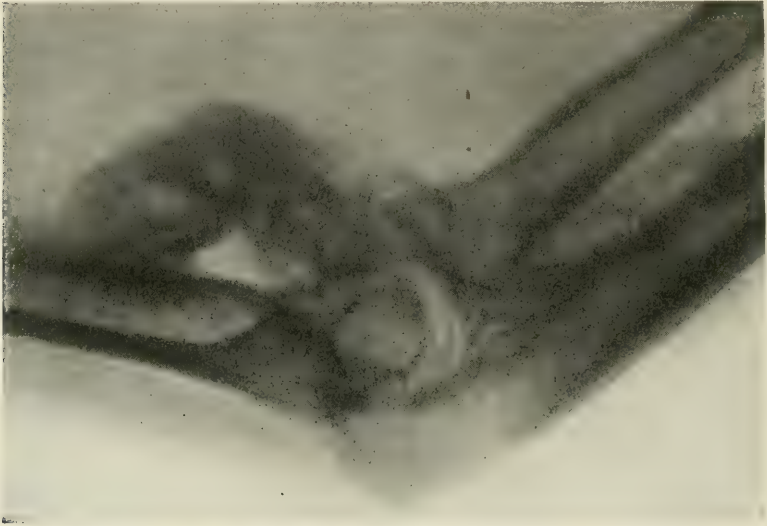


FIG. 16.—Osteophyte producing ankylosis of elbow. (Kessel.)

The cases of myositis investigated fell into three distinct clinical groups: (1) Cases of acute and chronic myositis, without other demon-

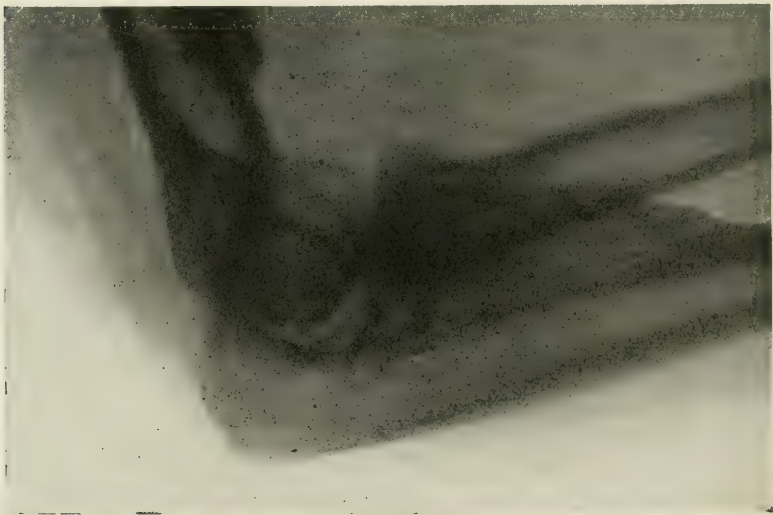


FIG. 17.—Osteophyte removed freeing joint. (Kessel.)

strable lesions at the time of study; (2) cases with predominating symptoms of myositis, in which periarthrititis and arthritis were present; and

(3) cases in which myositis was the chief factor, but there was associated neuritis or perineuritis.

Cultures from these three groups were injected intravenously into rabbits and the resulting lesions tabulated. In the first group were 90 animals, in the second 61 and in the third 51. Of the first group of animals, 88 per cent had muscle lesions, 16 per cent were found to have turbid joint fluid, and only 1 per cent had lesions in the nerves. In the second group the corresponding figures were 79 per cent, 28 per cent and 0 per cent, while in the third group they were 67 per cent, 8 per cent and 35 per cent. These results paralleled very closely the findings in the clinical cases, not only with regard to muscular lesions, but also with regard to the incidence of lesions in the joints in the arthritis group and in the nerves in the neuritis group.

The lesions were usually found between muscle fibers and, in the earlier lesions, extravasation of red blood cells, dilatation of adjacent capillaries, and edema, with loss of striation of the muscle fiber as the swelling increased, were the chief characteristics. Later, in larger lesions, fragmentation and necrosis of the muscle fibers occurred as leukocytic and other cells became numerous. Of 11 animals given injections of cultures of streptococci which had been killed with liquor formaldehyde, 8 showed lesions of the muscles. This indicates that the property of localization is resident within the bacterial cell.

Pathogenesis of Dupuytren's Contraction of the Palmar Fascia. Byford¹ reports 705 cases of Dupuytren's contraction recorded in literature, in addition to 38 personal cases. In these 38 cases, 5 showed a possible etiologic factor in a local condition; 4 had an injury or strain of one hand from six months to two years before the onset of the contraction. The injured cases were 13.4 per cent, too small a proportion for a probable etiology. Twenty-three cases were associated with rheumatism, and only 7 had constitutional disease. In Nichols' series of cases, Dupuytren's contraction and rheumatism were associated in 84 per cent, and in the writer's series in 60 per cent. The physical examination of the cases here reported showed them to have about the same physical defects as other people of their age and occupation. However, one very marked condition was noted, the almost universal disease of their teeth. Rheumatism is now quite generally considered to be due to focal infection. The association of rheumatism with Dupuytren's contraction in from 60 to 84 per cent of the cases makes it evident that a focal infection is at least quite commonly present in the latter condition. A source of infection was present in 97.3 per cent of cases, the most common location being the teeth. All foci of infection should be removed to prevent progression of the contraction. A period of six months should elapse between the removal of these foci and the treatment of the contraction itself, which is, of course, surgical.

Repair of Peripheral Nerves.² With the publication of the observations of Miller³ and Malone,⁴ the rationale of the surgical treatment of

¹ Medical Record, September 17, 1921, 100, 487.

² Editorial, Journal of the American Medical Association, February 25, 1922, No. 8, vol. 78.

³ Archives of Surgery, January, 1921, 2, 167.

⁴ Ibid, November, 1921, 3, 634.

injuries to peripheral nerves seems to be complete. Miller correlates the microscopic changes in the process of nerve regeneration with the gross changes and with the restoration of the tensile strength of the nerve at the point of suture, showing that, at the end of the fourth week, physical and physiologic healing alike are complete. Malone shows the practical application of the laws of reflex action to the determination of the presence or absence of conducting neurons at any point in the course of the regenerating nerve distal to the line of suture, demonstrating that the fact of physiologic healing in any sensory or mixed nerve may be proved by the elicitation of reflex respiratory stimulation on the application of a threshold stimulus at any point on the nerve trunk distal to the line of suture to or beyond which the axons have penetrated.

For many years it has been admitted that the first steps in the regeneration of peripheral nerves following section appeared as the proliferation of the nuclei of the neurilemma, with the formation of protoplasmic bands in the proximal and the peripheral segments of the divided nerve; but whether the neuraxis was of central origin or whether it might be formed complete in the peripheral segment and await only union with a similar element in the proximal segment to become a fully functioning nerve tract offered a field for debate. In 1912, Ransom¹ convincingly demonstrated the origin of the protoplasmic bands from the proliferation and growth of the cells of the neurilemma and the bridging of the suture line in a divided nerve by them. He further showed that the new axis cylinders appear on the eighth day as side branches above the zone of degeneration in the proximal stump, and travel distant across the gap and down the peripheral stump guided by the protoplasmic bands. Kirk and Lewis² observed similar phenomena after tubulizing with fascia a gap formed by the removal of a 10-mm. ($\frac{3}{8}$ -inch) segment of the sciatic nerve in dogs. They demonstrated that the protoplasmic bands which form bridged the gap within six days, and that the regenerated neuraxes from the proximal stump penetrate the distal segment within three weeks.

Huber, in 1919, called attention to the importance of the anatomic structure of the nerve trunk and to the nerve pattern. The nerve trunk he likened to a conduit system, each tube of the system leading to some definite point. In the regeneration of nerve fibers the protoplasmic bands, supported by the endoneurium, are comparable to the empty tubes of such a conduit system, some leading to motor end-plates, some to sensory end-organs. If the distal segment of the nerve were rotated so that the patterns of the distal and proximal segments no longer coincided, then motor nerves might find their way down sensory pathways, and sensory nerves might find their way to motor organs, and thus be as effectually lost as though they had never been regenerated. The demonstration that individual nerve fibers may not always occupy the same relative position in the nerve trunk, but may interweave with other fibers, to a certain extent need not deprive the nerve pattern

¹ Journal of Comparative Neurology, 1912, **22**, 487.

² Bulletin of the Johns Hopkins Hospital, February, 1917, **28**, 71.

idea of significance from the practical standpoint, although the longer the segment to be replaced, the more unlikely it appears that the proximal and distal nerve patterns in the unrotated segments would coincide. Also, the importance of the conception of the protoplasmic bands in the role of a conduit system remains unshaken.

Clinically, the advances in the technic of nerve suture have been so great as to render obsolete most of the time-honored methods of nerve-grafting and of tubulization of nerve defects by fascia, formalized veins and other ingenious, but highly uncertain, artifices. Today, with very few exceptions, defects in nerve trunks may be repaired by direct end-to-end suture, with reasonably bright prospects of success. This has been made possible by the development of five aids to the approximation of the ends of a divided nerve. Briefly, these methods are: (1) Mobilization of the nerve by open dissection for considerable distances above and below the point of suture; much more may be gained in this manner by stretching the nerve without first dissecting it free. (2) Adduction, or extension of limbs, as may be indicated in order to relax the nerve trunk. (3) Flexion of joints, as the elbow and wrist, in lesions of the nerve trunks of the forearm. (4) Transposition of nerve trunks to shorter routes. (5) A two-stage operation; at the first sitting, the fibrous ends of the divided nerve are approximated as closely as possible, by means of the proper application of the four devices mentioned above, and sutured. During the succeeding weeks the nerve is stretched by permitting gradual extension and abduction of the limbs so that at the second sitting it may be possible to obtain direct approximation of the nerve segments after proper excision of the impervious fibrous end-bulbs. Naffziger¹ estimates that by the proper combination of methods, gaps of 10 cm. (4 inches) or more in the chief nerve trunks of the extremities may be successfully bridged and end-to-end suture obtained.

END-RESULTS OF NERVE-GRAFTING IN SURGERY OF NERVE WOUNDS. During the last three years we have devoted considerable space to the subject of surgery of the peripheral nerves because of the unusual amount of material which has resulted from the Great War. It is, therefore, opportune, to report the various end-results which are now appearing in literature.

Gosset and Charrier² classify their results as follows: Good, if sensory and motor regeneration has occurred; mediocre, if there are only signs of sensory return with slight motor or electric reaction; and poor, if there is no evidence of regeneration. They agree with most reports, that the results obtained by direct end-to-end suture are better than those obtained by nerve-grafting. However, they do report an unusual percentage of good results obtained by nerve-grafting, of which autografting is the best. Of the autograft operations performed by the authors, 35 per cent gave good results, 45 per cent mediocre results, and 20 per cent poor results. Of 2 heterograft operations performed by them, both were failures. These results compare with the reports of

¹ Surgery, Gynecology and Obstetrics, March, 1921, **32**, 193.

² Jour. de Chir., 1922, **19**, 1.

other surgeons, except that they found the reports of 2 successful heterografts performed by French surgeons. These reports are the most favorable we have encountered in the surgery of the peripheral nerve.

Studies in Reduction of Bone Density. Phemister¹ says that reduction in the density of bone may be local, regional or general—according to the cause. In bone infections there are four processes by which reduction in density may be produced: (1) There is destruction of dead bone at the seat of greatest inflammatory activity; (2) there is local destruction of living bone or caries; (3) there is rarefying osteitis in the neighboring living bone for variable distances about the area of complete bone destruction; (4) there is regional atrophy of disease. In osteomyelitis bone necrosis results from the effect of the toxins in the most severely inflamed region. The unossified elements of the dead bone are rapidly killed by toxins and removed by the action of the serum and leukocytes. The calcareous deposits are only removed as a reparative process by the absorptive action of the granulations. From six to fifteen days elapse before signs of reduction in density can be shown by the roentgen ray. Tuberculosis usually produces localized osteitis. The metaphyseal region of the end of the bone is more frequently involved primarily, especially during the first decade. After the tenth year, primary foci in the epiphyses are seen with increasing frequency. Ingrowth of tubercular granulation tissue beneath the articular cartilage is a common occurrence leading to destruction of the articular cortex of bone and to disappearance of the sharp line which it normally casts in roentgen rays. Bone syphilis produces gummatous caries in irregularly distributed and various-sized areas. Shadows from new bone formation are frequently interspersed. In bone tumors reduction of density results almost entirely from breaking-down of living bone by cellular activity. In metastatic carcinoma of bones the relative amounts of bone destruction and new bone formation bear some relation to the seat of the primary tumor and its degree of malignancy and rate of growth.

Metastatic carcinoma of the breast tends to produce bone destruction with little associated new bone formation, while carcinoma of the prostate produces little bone destruction and much new bone formation. Reduction in density in sarcoma usually occurs *en masse*, and, while the outline of the area of destruction may be irregular, extensive pocket formation is uncommon. New bone formation in the ossifying types of sarcoma may be sufficiently extensive to offset the reduction in density resulting from bone destruction, but its distribution and arrangement are usually such that the shadows cast are of diagnostic significance. Central giant-celled tumors affecting the ends of the living bones form a special group, and it is questioned whether they should be classified with sarcomas. They reduce bone density by eccentric growth and are entirely devoid of any tendency to undergo ossification. The reduction of density in bone cysts is quite similar to that in giant-celled

¹ American Journal of Roentgenology, 1921, 8, 355.

tumors in that the process begins in the interior of the bone and produces eccentric erosion without subsequent ossification of the tissue which caused the erosion. Small perforations of the cortex are more common. The site affected is farther from the bone end.

Bone-grafting. McWilliams¹ makes some comparisons of the various methods of bone-grafting based upon 1390 cases that he has been able to analyze. These do not include Albee's statistics, which he says were not available. There are three requirements of a successful bone graft: (1) It must bridge a defect; (2) it must be of a size and type to reestablish circulation; (3) it must act as a stimulus to osteogenesis. Raw living bone is a very powerful stimulus of this kind and the osteoperiosteal grafts offer a very large area of raw bone and hence are to be preferred to all other methods of grafting.

There is much in osteogenesis that is still unknown, namely, the chemistry and physiology of the process. Why a bone graft will sometimes melt away in the tissues and be absorbed and its place not taken by new bone we cannot explain. It is one of the most disappointing results of a well-conceived and well-carried-out bone-graft procedure, and it happens to every one and occurs in all methods.

From these 1390 bone-graftings he finds:

1. That there was a total of 82.3 per cent of successes, with 17.6 per cent failures.

2. In the order of successes, we have:

- (a) With bone pegs, 95.8 per cent were successful.
- (b) With the osteoperiosteal method (Delageniere), 87.3 per cent successful.
- (c) With the end-to-end method (without inlaying), 82.5 per cent were successful.
- (d) With the inlay method, 80.9 per cent were successful.
- (e) With the intramedullary method (Murphy), 75.6 per cent were successful.
- (f) With the combined intramedullary (at one end) and the inlay (at the other), 60 per cent were successful.

3. The presence or absence of periosteum seems to exert no influence on the success of bone grafts. Proportionately, the percentage of successes without periosteum (82.3 per cent) is the same as with (82.9 per cent). In the end-to-end method there were 18 per cent more successes than failures without periosteum, and in the inlay method 9 per cent more successes without periosteum than with; while, on the contrary, with the intramedullary method there were 13 per cent more successes with grafts with periosteum than without. It is difficult to explain the cause of the differences in the various methods.

4. Suppuration occurred in 121 cases, or 8 per cent; 32 per cent of these succeeded. Suppuration is the most frequent cause of non-success of graftings, with insufficient immobilization and too short duration as the second most frequent cause.

5. The conclusion is reached that the most successful method of bone-

¹ Transactions of the American Surgical Association, 1921, **39**, 600.

grafting is by the osteoperiosteal method (Delageniere). The bony defect should be filled in with small bone chips, and on the overlapping ends of the fragments covering in the bone chips should be placed one or two strips of periosteum with adherent osseous plaques taken from another bone. This method is as applicable to large as to small bony defects.

6. The cause of many non-successes is due to defective immobilization or to undue curtailment of its length. From four to six months' immobilization is ordinarily required for complete success.

7. There is sufficient evidence to prove that the most effectual treatment of non-union of fractures is bone-grafting.

8. The causes of failures of bone-graftings, summarized, are:

(a) Improper method of grafting.

(b) Suppuration.

(c) Insufficient immobilization, or over too short a period of time.

(d) Fracture and dislocation of the grafts.

(e) Atrophy of the ends of the bone to be grafted.

9. The intramedullary method of grafting should be discarded.

Fractures. In a very interesting way Scudder¹ discusses certain problems in the treatment of fractures of bones. Though pertinent they are not new, and he quotes Hippocrates' writing in 400 B. C. "I know physicians who have the reputation of being skilled in giving the proper positions to the arm and binding it up after fracture, while in reality they are only showing their ignorance. But many other things in our art are judged of in this manner for people rather admire what is new, although they do not know whether it is proper or not, than what they are accustomed to and know already to be proper; and what is strange, they prefer to what is obvious."

Under the term fracture of bone Scudder includes:

Fracture of the skull, protector of the brain.

Fracture of the spine, so adequately shielding the cord from injury.

Fracture of the thorax, with possible damage to the contained pleura, lung and heart.

Fracture of the pelvis, containing abdominal organs sometimes seriously damaged.

Fracture of the long and short bones of the upper and lower extremities.

Fracture of the articular surfaces of all joints.

Gunshot fractures of the skeleton.

Open or compound fracture, potentially infected wounds.

All dislocations.

It will not be forgotten that associated with these fractures there may be contused and lacerated wounds, and there may be sprains of joints distant from the apparent injury. Shock may be present, slight or serious. In addition, damage to muscles, to single nerves or nerve plexuses, to tendons and to important bloodvessels may complicate the situation.

¹ Transactions of the American Surgical Association, 1921, **39**, 580.

There are certain problems necessarily included in this group of injuries which are not altogether settled, viz.:

- (a) The process of repair of fractures.
- (b) The causes of ununited fractures.
- (c) The treatment of ununited fractures.
- (d) The repair of pathologic fractures.
- (e) The proper handling of crushed fractures.
- (f) The treatment of malunited fractures.

General surgeons, as a group, are not interested in treating fractures. There are, of course, exceptions in every community, but the average man has been attracted to the more dramatic fields of abdominal surgery. As a consequence, at the present time, the collective results of fracture treatment throughout this country are deplorably poor. The community itself, every fracture patient, and the working man in particular, are all asking for better results. The employer of labor is demanding that injured men be returned to work more quickly and that fewer hours be lost.

To meet these demands, Scudder has definite suggestions:

1. The organization of a fracture service in each of the large hospitals of the country. This should consist in:

- (a) Special wards.
- (b) A special fracture personnel consisting of a chief, who should be a surgeon of broad general experience, and with him should be assistants and the whole service should be continuous throughout the year.
- (c) This continuous control should include the out-patient service, where the ambulatory cases are received and treated, and the policies of the out-patient and house-fractures service should be identical and under the same personnel.
- (d) The emergency ward or accident service, insofar as fractures are concerned, should likewise be under the direct care of the chief of this service. A fracture should be considered as much of an emergency as is a case of perforated gastric ulcer. The initial treatment is vital to a satisfactory outcome in both instances.

2. Adequate instruction of the undergraduate medical students.

3. By instituting smaller hospital units in towns adjacent to and remote from large centers. The equipping of such hospitals with adequate apparatus and the instruction of certain interested physicians or surgeons of the community in the care of fractures by individual surgeons from the larger centers.

4. Graduate instruction of the general practitioner interested in fractures.

5. By encouraging the specialization within general surgery of the surgery of fractures.

6. The organization of a clinical surgical fracture society.

The report of the Committee¹ on Fractures of the American Surgical Association has very definite suggestions upon this subject, and we quote at length.

¹ Transactions of the American Surgical Association, 1921, vol. 39.

The Committee finds:

1. The results are best in the age period under fifteen years. Conservative treatment is generally effectual during this period.

2. Good anatomic restitution of a fractured long bone results in the best functional results and has the shortest period of disability.

3. While comparatively few open operations are reported under the fifteen-year age period, it seems to make little difference in the result, except in senile cases (where it is unfavorable), what the age period is when the operation is done.

4. The end-results of non-operative and operative treatment of compound fractures show very little difference in the anatomic result, but the functional results are better after operative treatment, except in compound fractures of the shafts of both bones of the leg; here the reverse seems to be true.

5. The average period of disability (that is, the time lost from work) in fractures is as follows:

SIMPLE FRACTURES.

For fractures of the shaft of the humerus	14.0 weeks
For fractures of the head and neck of humerus	11.5 "
For fractures of the condyles of the humerus	9.0 "
For fractures of the shaft of both bones of forearm	10.9 "
For fractures of the femur, all sites, adult cases	8.2 months
For fractures of the femur, all sites, children	4.5 "
For fractures of the leg, all sites	4.7 "

(Periods of disability were not recorded accurately in many of the reported cases and very seldom in compound fractures.)

COMPOUND FRACTURES.

For fractures of the femur	11.0 months
For fractures of the leg	7.0 "
For fractures of the upper extremity	4.0 "

6. For good functional results the humerus should show not more than 1 cm. shortening and no appreciable angulation. No pain or paralysis should result.

The forearm bones should show no shortening; function should always be good and no lasting pain result.

Fractures of the shaft of the femur should not result in shortening greater than 2 cm., nor in a fixed position of angulation or rotation. The function of all joints should be good.

Fractures of the shaft of the bones of the leg should result in no appreciable shortening and no angulation or rotation. All function of the joints should be preserved.

7. There is no method or splint universally applicable; all depends upon the discrimination of the surgeon and the manner in which the apparatus is applied and maintained.

The late war has brought into prominence the suspension-traction method for treating fractures. The Balkan frame or the Hodgen splint for suspension is used, and tongs or the Steinmann nail are used

for traction directly on the distal fragments. The Thomas splint has proved of great value in the treatment of fractures of the shaft of the femur; it is recommended especially when hospital treatment cannot be obtained.

Plaster casts and molded splints are indicated and are useful only after a fracture has been satisfactorily reduced.

RECOMMENDATIONS. 1. The Committee recommends, as a general principle, that fractures be treated by a skilled surgeon.

2. Roentgen-ray pictures should be made by a competent roentgenographer and a fluoroscope should be used for diagnostic purposes and for guidance in applying the permanent dressing. At least two roentgenograms should be taken, and they should be taken from opposite perpendicular directions. Roentgenograms should also be taken after permanent dressings are applied, to prove proper reduction, and at the end of treatment to show the results of the union and for the purpose of a graphic record.

3. Fracture should be reduced immediately after the injury if it is possible to obtain and apply proper retaining apparatus or splints. The statistics show markedly better results when the treatment is begun at once. It is, however, not only useless, but cruel to subject the patient to the pain of manipulation for reduction unless the surgeon has proper fixation apparatus at hand and the subject is where he may have a permanent dressing applied.

4. General anesthesia should be employed, as a rule, to facilitate reduction and to prevent pain, unless the condition of the patient contraindicates it.

5. Neither the non-operative nor the operative methods is to be recommended exclusively. Each has its indications and should be employed when required. Generally speaking, the age period under fifteen years is the period in which non-operative methods are especially effectual.

6. The open method when adopted should be employed early. It may be used at any age period, except in senile cases, whenever a roentgenogram shows a deformity or a position of the fragments, which obviously cannot be reduced or when proper efforts at reduction and retention have proved unavailing.

7. Some form of rigid plate applied directly to the bone seems to be the best fixation method in operative cases.

8. Open operations for simple fractures should be undertaken only by experienced surgeons, who are thoroughly equipped by training, and who have proper instruments and apparatus to meet all the possible indications of the operation.

9. After fracture of the long bones of the lower extremity some efficient form of caliper should be used when the patient begins to walk, and should be continued for some weeks in order to prevent yielding of the newly united fragments to the weight of the body and the production of bending and distortion at the seat of fracture.

10. The treatment of any fracture ought not to be considered complete until full restitution of functions has been secured. For this

purpose every hospital which treats fractures should be equipped with apparatus for mechanic, electric and hydropathic treatment. The reconstructive treatment should be considered in every case an essential part of the general treatment. Also, in order to make the record of every case of major fracture complete, a careful follow-up system should be adopted and sedulously followed.

11. The work of this committee has been greatly hampered by the inadequacy of the records submitted for its consideration. A large proportion of the cases had to be rejected entirely, and most of them were so incomplete as to make deductions based upon them misleading.

The first step in the betterment of practice is the study of results achieved by present-day methods. An adequate study is impossible without complete records.

FRACTURES OF TRANSVERSE PROCESSES OF THE LUMBAR VERTEBRÆ. Davis¹ claims that fractures of the transverse processes of the lumbar vertebræ are not infrequent injuries, but have been frequently overlooked. With modern improvement of our roentgen-ray technic, aided by the use of duplitzed films, intensifying screens, and especially the Potter-Bucky diaphragm, many cases formerly diagnosed "sprained back" "malingering," etc., are now found to be fractures of the transverse processes.

In reviewing the literature on this subject, there seems to be considerable difference of opinion as to the factor in causing the fracture. Some observers (Hartwell,² Roberts and Kelly³ and others) state that the process fractures result almost invariably from direct trauma. DeQuervain,⁴ Treves⁵ and others say that the injury may result from direct or indirect violence. Stimson⁶ states that fractures of the transverse processes occur in combination with other fractures, but are rare, except in such cases, and that in the few instances in which fracture has occurred alone, it is the result of gunshot injury. Rhys⁷ states that these fractures are developmental in origin, adding that fractures occur in the absence of injury in almost all cases, and that the first lumbar is the most frequently affected.

The muscle, in which we are most interested in considering transverse process fractures in the lumbar region, is the quadratus lumborum. It is irregularly quadrilateral in shape and broader below than above. It arises by aponeurotic fibers from the iliolumbar ligament and the adjacent portion of the iliac crest for about 5 cm., and is inserted into the lower border of the last rib for about half its length and by small tendons into the apices of the transverse processes of the lumbar vertebræ.

The action of the quadratus lumborum muscle is to draw down the last rib and it acts as a muscle of inspiration by helping to fix the origin of the diaphragm. If the thorax and vertebral column are fixed, it

¹ Surgery, Gynecology and Obstetrics, 1921, No. 33, **3**, 272.

² Colorado Medicine, April, 1919.

³ Clinical Surgical Diagnosis, p. 535.

⁴ Fractures and Dislocations, p. 150.

⁵ British Medical Journal, May 24, 1918.

⁶ Fractures, p. 219.

⁷ Applied Anatomy, p. 657.

may act upon the pelvis, raising it toward its own side when only one muscle is put in action, and when both muscles act together, either from below or above, they flex the trunk.

Now if the thorax, spine and pelvis are all three fixed and a force is applied to the muscle, it is evident that something must give, and a fracture of the transverse process, a separation of a lumbar rib, or a separation of the twelfth rib, or a combination of these, results. That is by indirect violence. And it is the writer's opinion that practically all of these fractures occur in this manner.

If the patient is under twenty-five years of age it is possible that the secondary ossific centers present a *locus minoris resistentiæ* at their union with the primary ossific centers of the transverse process.

The *symptomatology* of these injuries is definite. Pain in the back; "backache" is the chief symptom. The pain is well localized, constant and does not radiate. It is exaggerated by any motion that changes the line of the weight of the body. Rising from the recumbent to the sitting position and from the sitting to the erect position increases the pain. In no position other than lying relaxed in bed is the patient free from pain. Flexion and hyperextension of the spine, and lateral bending, both toward and from the injured side, cause pain. Bending toward the injured side sometimes causes more pain than bending from the injured side.

Roentgen-ray examinations of these cases may show a linear fracture with the fragment in good position. More often, however, there is considerable diastasis of the fragments. If there is a lumbar rib this may be seen dislocated from its articulation with the spine, or the same may be true of the twelfth rib.

Oudard¹ gives short histories of 7 unpublished cases of isolated fractures of the transverse processes of the lumbar vertebræ, 5 of which were cases of his own. In the literature he has found the reports of 31 cases published since the first case was described by Kalthoener in 1891. As a rule, only one process is fractured. Multiple fractures are exceptional.

FRACTURE OF BONES OF FOREARM. In a report of the Committee of the American Surgical Association, 1921, Martin and Eliason² state that non-operative treatment gave good functional results in 78 per cent, as compared with 68 per cent operative, and showed only 2 per cent bad functional results as compared to 13 per cent bad functional results in operative cases. The cases operated upon were in the main those in which injury was most extensive and delay in adequate treatment most pronounced.

REDUCTION OF FRACTURES OF THE LOWER END OF THE RADIUS. Jopson³ employs general anesthesia for all reductions of Colles's fracture. He uses a wedge-shaped wooden block, covered with a towel, on which the patient's arm is rested, flexor surface down. An assistant holds the arm so that the supporting block comes just above the lower end

¹ Bull. et mém. Soc. de chir. de Paris, 1921, **17**, 706.

² Transactions of the American Surgical Association, 1921, **39**, 519.

³ International Clinics, 1921, Series 31, **3**, 250.

of the upper fragment. This gives fixation and leverage for the surgeon, who grasps the hand and wrist below the fracture and pursues the usual maneuvers, namely, overextension (to release the fragment), forward and downward traction and flexion of the wrist. The displacement is thoroughly reduced and even slightly overcorrected. A padded splint is applied until a secure callus is formed. The fingers are left free and frequent dressings and massage are practised. The period of splint support is varied according to the type of the fracture.

FRACTURE OF THE SCAPHOID BONE (WRIST). Saner¹ reports 3 cases of fracture of the scaphoid bone. The immediate signs and symptoms are sharp pain, followed by swelling of the wrist-joint, and all movements, especially extension, are painful. On palpation, the joint is tender, the area of greatest tenderness being immediately distal to the lower end of the radius on the posterior aspect of the joint. The history of a fall on the hand and somewhat thickened, weak and painful wrist with very restricted movements, is almost diagnostic of an old-standing injury to a carpal bone, most commonly the scaphoid. In all cases two or more articular surfaces are involved. Owing to the small size of the fragments, they atrophy rapidly; on this account, and often also on account of lack of treatment in the early stages, it may be said that fracture of the scaphoid is the rule, rather than the exception. When seen early the forearm and hand are splinted, with the wrist slightly extended. Massage is begun during the first week, as well as some active movements of the fingers, but the wrist should be kept immobilized for at least three weeks. There is no guarantee, even with the best care, that union will occur and the prognosis is always doubtful. In late cases, with non-union, it may be worth while excising the scaphoid. The end-results of excision of the scaphoid vary with the length of time that elapses between the injury and the operation, in other words, to what extent arthritic changes have developed. The operation cannot restore a wrist to normal; its main object is to alleviate pain and thus give a greater freedom of use, especially in the power to grip, and consequently increased strength. In some cases removal of the scaphoid gives increased movement, while in others there is no alteration.

MECHANICS OF REDUCTION IN THE TREATMENT OF SPIRAL FRACTURES. In a discussion of this subject, Rixford² includes only those fractures which are typical spiral fractures and are the result of torsion. The frequency of this type of fracture has not been realized in the past. Thus, Stimson, in 1912, says they are rare, and Scudder, in 1911, does not mention them. Zuppinger estimates that 26 per cent of all fractures of the tibia are spiral, and that 39 per cent of all fractures of the shaft of the tibia are of this type, and Rixford feels that these figures are probably low.

The average results of treatment of this type of fracture are unsatisfactory, both anatomically and functionally. Non-union is frequent in spiral fractures of the lower third, and irregularity of the bone is a rule,

¹ Practitioner, London, November, 1921, **107**, 367.

² Transactions of the American Surgical Association, 1921, **39**, 589.

even when union takes place and there is nearly always an external rotation of the lower fragment, with a frequent anterior flexion deformity and more or less shortening. In addition, there is frequently abduction which is, at times, of sufficient degree, especially when associated with external rotation, to be the cause of breaking down of the arch of the foot and a resulting pronation and flat foot.

Spiral fractures of the shaft of the long bone are the result of torsion. The fundamental principles determining the direction of the spiral and the pitch were worked out by Zuppinger.¹

In practice we find that other forces are active besides torsion at the moment of the fracture and afterward. This is especially true of the lower extremities where weight-bearing, augmented in its effect by momentum in running and jumping, adds an important element of longitudinal thrust. If this thrust is active after the spiral fracture is complete, it will then cause the fragments to pass by each other and the periosteum on the side of the vertical component of the fracture, not being torn apart, will be stripped from one or both pointed ends of the fragments and remain as a periosteal bridge. Thus, clinically, we usually find the tips of the fragments in spiral fractures denuded of their periosteum. The fragments under these circumstances are so free to move in any direction that their sharp projecting points and knife-like edges may lacerate muscles, nerves, bloodvessels, neighboring joints and often perforate the skin, making the fracture compound. These long points of the fragments may also be broken off by the bending of the limb at the point of fracture.

From the above considerations, and the complicated form of the spiral fracture, it is evident that if the fracture is not perfectly reduced there is practically no reduction at all. The untorn periosteal bridge, being attached along the sides of the bone more or less opposite to the spiral component of fracture, is very short, and it usually effectually prevents the correction of rotary displacement and is one of the reasons for the common clinical experience of the persistence of external rotation after union of a spiral fracture.

Rixford believes that, from a practical point of view, spiral fractures of the long bones are never reduced except in open operation. While not an advocate of the open treatment of fractures in general, or even in any very large proportion of cases, he is convinced that in his experience early operative reduction and fixation of spiral fractures of the long bones have given far better results than traction and external fixation. In the choice of operative or non-operative treatment, Rixford insists that the mechanic problems involved and the anatomic displacements resulting in this type of fracture so predispose to malunion that it is never justifiable to wait until this condition of malunion develops before operating and he submits that, barring definite contraindications to operations in general, all spiral fractures of the long bones in adults and adolescents, and some in children, be managed by open early operation.

¹ Beitr. z. klin. Chir., 1906, 52, 391; 1909, 64, 562.

The technic he suggests is as follows: 1. Determine the location and form of the fracture by roentgen-ray studies, and locate that part of the spiral portion which is opposite the longitudinal component.

2. Cut down on this spiral part of the fracture and remove all detached chips of bone and any larger fragments if they are not required as a part of the splintage and drill both fragments, if possible, with a minimum disturbance of their position, in a line obliquely to the spiral that will most effectively resist torsion displacement. In general, this line will be transverse to the axis of the bone.

3. Pass a stout silver wire through the drill holes.

4. Reduce the fracture by traction, rotation and leverage. Draw the wire taught and then hammer the ends down into the bone.

5. Close the wound and apply fixation apparatus, such as a Thomas splint or plaster of Paris.

6. Remove the fixation appliance frequently to permit of massage, mobilization of the joint, and electric development of the muscles and arrange for the patient to make functional use at the earliest possible moment.

We can agree to most of this report, but take exception to his use of silver wire and drill holes for internal fixation. In our experience the Parham band has been easier to apply, causes less injury to the bone and has remained in the tissues with less disturbance than any other form of foreign body. Nor can we agree with his statement that all spiral fractures should be treated by open operation. Excellent functional results, one might almost say perfect functional results, can be obtained in spiral fractures of the tibia when treated with skeletal traction.

Caldwell¹ also regards open operation as the best in spiral fractures and advocates the use of the band.

He advocates the removal of the band in two or three months. Most of his cases have refused to accept this advice, and this has been our experience for we have not been able to remove but one of ours, because of the absence of symptoms and the refusal of the patient.

SUSPENSION-TRACTION TREATMENT OF FRACTURES OF THE LONG BONES NEAR LARGE JOINTS. Each year we have devoted so much space to the subject of the suspension-traction treatment of the fractures of the long bones that it is with some hesitancy that we again refer to the subject. In the past our references have been largely due to the experiences, personal sometimes, of military surgeons, and this year the literature contains a number of reports of its use in civil surgery.

Hartwell² contributes a report that should be carefully studied by every surgeon. He reviews the underlying principles, which make for efficiency in the suspension-traction treatment of fractures of the long bones.

We appreciate Hartwell's emphasis that the application of these principles is often beset with difficulty and that patient and untiring effort alone will be rewarded with success. It is a method that can

¹ *Annals of Surgery*, June, 1922, No. 6, vol. 75.

² *Transactions of the American Surgical Association*, 1921, 39, 612.

be applied only after considerable experience and with attention to detail that many surgeons are unwilling to give. He might have said that it was a method that was laboriously taught to a very large number of young surgeons during their military service, both abroad and in this country, but if one was compelled to judge of its value by its general use in the civilian hospitals by these men at the present time, we would soon hear very little about it. As an inspector of hospitals, one



FIG. 18



FIG. 19

FIG. 18.—Spiral fracture of tibia. Fracture of fibula as usual does not show in roentgenogram taken of tibial fracture, but the shortening of one-half to three-fourths inch indicated by radiogram is proof that the fibula is broken at some point. (Caldwell.)

FIG. 19.—Roentgenogram taken same time as Fig. 18, showing fracture of fibula just below knee. (Caldwell.)

of our greatest disappointments has been to find that the younger surgeons have not persevered in this line of treatment. It may be that it is not alone the difficulties of the method itself, but the added difficulties of introducing it into the surgical services of older and more conservative men, and the universal disinclination on the part of the administrative departments of all hospitals to try anything new that requires the investment of money. This is the excuse which we

ourselves are compelled to offer, and to read such a report as Hartwell is able to give of what he has accomplished at Bellevue should encourage everyone to make a similar effort, but its greater value is that it



FIG. 20.—Roentgenogram taken after band was applied. No splint was applied, but leg was laid in a wire basket for ten days. In eight weeks band was removed, at which time patient was walking comfortably. (Caldwell.)

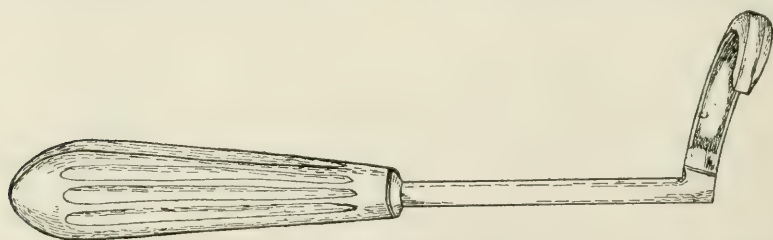


FIG. 21.—Instrument to facilitate Parham-Martin band about bone. (Caldwell.)

is a complete demonstration which we can offer to our various hospital organizations.

Hartwell states that every fracture in his service is made an emergency case. That statement itself is sufficient as a text for a course of

lectures in the surgical care of fractures. At a recent conference of the American College of Surgeons on the subject of fractures, it was the consensus of opinion that probably the greatest factor in the present unnecessary disability, resulting from improper care of this class of injuries, was the primary treatment. This primary treatment, of necessity, must be entrusted to the hospital interns; usually the ambulance or accident-ward man, who, in the majority of cases, is the youngest intern in the hospital. This is a matter of hospital administration and easily corrected if the necessity is appreciated of placing all emergency treatment in charge of the senior house officer. But this lack of appreciation of the gravity of fractures does not begin with the hospital organization, but in the medical schools themselves, and there are very few men at the present time who are taught that every fracture case should be considered a major surgical emergency, and that its treatment should be undertaken immediately on admission.

In the cases which he reports, though he lays no particular stress upon it, we would like to emphasize as the third important point in his paper, namely, that the patients are not allowed to walk until fitted with a caliper splint, and that the braces are not removed until after wearing them for six months.

Jones has called attention to this in his report of the end-results of fractures of the femur caused by gunshot wounds. The orthopedists have long realized the necessity of supporting fractured bones with adequate braces until they become sufficiently rigid to hold the body weight without bending. It has, however, been our experience that it is one of the most difficult innovations in hospital practice to persuade the surgeons and the patients of the necessity of this prolonged bracing.

FRACTURES OF THE LEG BONES INVOLVING THE ANKLE. In spite of all the classic writings of Pott, Dupuytren and others, there is no entirely satisfactory classification of ankle fractures. Pott described a fracture which does not exist, and Dupuytren commended him for his acute observation. A transverse fracture of the fibula 3 inches from the lower end, as described by Pott, is not found in any series of roentgenograms or postmortem specimens. Quénu states that the French mean by "Dupuytren's fracture" exactly what the English mean by "Pott's fracture." It is probable that this fracture is the common one first described accurately by Maisonneuve.

Ashhurst and Bromer¹ state that in the production of fractures of the ankle, rotation of the foot around the long axis of the leg play an important part. Inward rotation is almost inseparable from a movement of adduction and the foot is quite mobile in this direction. In outward rotation, however, the foot acts as a rigid lever. In relation to the tibia, this is a lever of the first class, with the fulcrum at the anterior border of the fibula, the power arm being the anterior four-fifths, and the weight arm the posterior one-fifth, of the distance from the posterior border of the ankle to the toes. With relation to the fibula, however, it is a lever of the second class, with the fulcrum at

¹ Archives of Surgery, 1922, 4, 51.

the posterior border of the inner malleolus, and the power arm the entire distance from the posterior ankle border to the toes. The longer power exerts more force against the external malleolus than the shorter power arm exerts against the internal malleolus. The lower end of the fibula is thus fractured by a force which pries the malleoli apart. Of all fractures at the ankle, this oblique one of the lower end of the fibula is the most frequent (25 per cent). If the rotation goes far enough the tip of the internal malleolus is broken off. In their series of 300 cases, this type of rotation fracture, including all its complications and variations, occurred 100 times. In 4 cases the force against the internal malleolus was great enough to fracture the entire lower end of the tibia.

Forced abduction produces in most cases an isolated fracture of the internal malleolus. In their series 6.5 per cent were of this type. If the tibio-fibular ligaments hold, the fibula may be caused to break through its malleolus by the direct force of the abduction, but never above these ligaments by bending. A bending fracture occurs only when the tibio-fibular ligaments have ruptured; one end of the bone must be free and the other end fixed. In 30 cases of fracture of the surgical neck of the fibula, the lesion showed the characteristics of fracture by bending in 28, and if it was not accompanied by rupture of the tibio-fibular ligaments there was a history of direct violence or clinical evidence of severe sprain of these ligaments.

Not infrequently the posterior marginal fragment of the tibia is a distinct clinical entity. It was described by Cooper, in 1820, but, in 1915, Cotton described it as a "new type of ankle fracture," and by some writers it is referred to as "Cotton's fracture." The fragment varies from a small portion of the posterior lip to a large piece extending 10 cm. up the shaft, and there may be posterior displacement of the foot. The mechanism which produces it is a crushing force from below upward. This type of fracture occurred in 58 of the 300 cases reviewed.

Forced adduction may cause splitting of the inner part of the tibial shaft, but the more common lesion is a tearing off of the external malleolus followed by a crushing fracture of the inner malleolus.

The three abnormal movements of external rotation, abduction and adduction are responsible for about 95 per cent of ankle fractures. It is impossible to classify these fractures anatomically because the variations in many instances are due only to variation in the force which produces them. The authors, therefore, offer a classification based on the mechanism of the fracture.

On the basis of a roentgen-ray study of the ankle-joint, Bromer warns that in making a diagnosis of fracture of the posterior lip of the tibial-articular surface, one should remember that a supernumerary bone, the *os trigonum*, is sometimes present at this point. With regard to the diagnosis of tibio-fibular diastasis by the roentgen ray, the authors state that if the space between the lateral margin of the fibula and the lateral border of the anterior tibial tubercle exceeds more than two-thirds of the width of the fibula, it is most probably that there is diastasis of the first degree. Emphasis is placed on standardized accu-

ate technic in roentgenography. Gross lesions are easily recognized by almost any method, but to attain the finer points in diagnosis an exact method of technic is necessary.

FRACTURE OF THE NECK OF THE FEMUR. Whitman's method of traction, abduction and inward rotation of the limb and immobilization in a plaster cast is receiving more and more favorable comment each year. Ridlon¹ advocates this method, as do many others, but he very timely calls attention to a study which he has made of results of fracture of the neck of the femur during the past twenty-nine years, and in which there were many cases in which practically no treatment whatever had been given and excellent results had been obtained. This does not mean that he advocates non-treatment, but it does more than raise the question that good results are sometimes due as much to the natural tendency of fractures to heal as to any peculiar treatment they may receive.

Galloway,² writing upon the same subject, divides his cases of fracture of the neck of the femur into several groups. The first includes persons of advanced age, poor general physical condition and low resistance. In such cases the saving of life is the essential object, and the treatment of the fracture should be secondary. We entirely agree with this statement and feel that in some of the present enthusiasm for newer methods of treatment this is entirely overlooked, and the mortality in this group has been unnecessarily increased as a result. The second group includes patients who recover rapidly from the first shock of the accident and whose physical condition permits maximum treatment of the fracture. To this type of case Galloway applies the Whitman cast, as is general at the present time.

FRACTURES OF THE COTYLOID CAVITY BY ENFORCEMENT AND CENTRAL LUXATION OF THE FEMUR. Although these lesions are generally taught separately, a study of 53 cases in the literature and 1 personal observation has led Delannoy³ to consider them as different degrees of the same condition.

The first case of this condition was reported by Ambrose Pare in 1788. Before the general use of roentgen rays the diagnosis was often difficult, and many cases went undiagnosed. The injury is rare before the tenth year, probably because of elasticity of the bone, while most cases have occurred between thirty and forty. The causes are, in the order of frequency: (1) A fall on the hip; (2) on the feet; (3) on the shoulder. The line of force must be directed in such a way that the femoral head strikes directly against the thinnest part of the acetabulum, which is the postero-inferior portion. Mild abduction is the most favorable position of the limb. A fall upon the feet is often followed by a fall on the trochanters, so that it is not always possible to say which caused the injury. Marked abduction, however, brings the femoral head downward so that a fracture is more likely to occur. A few isolated cases due to falls on the shoulder have been reported.

¹ Journal of the American Medical Association, 1921, **77**, 1815.

² Surgery, Gynecology and Obstetrics, 1921, **33**, 692.

³ Rev. de chir., Paris, May, 1921, **40**, 317.

Fractures of the acetabulum without central dislocation of the head of the femur are very rare, so that it seems as if the displacement was primary and not a secondary occurrence from muscular pull. The lines of fracture are most often vertical, horizontal or star shaped. In fractures of the bursting type the displacement is slight since the inner pelvic muscles and the periosteum hold the fragments in place.



FIG. 22.—Case 1 (from above and behind). Huge broadening of heel, with the peroneal plate shoved up squarely against the external malleolus. White dotted line shows roughly the amount of bone removed at operation. (Cotton.)

FRACTURES OF THE OS CALCIS. Cotton,¹ in a very interesting way, calls attention to the uncommon fracture of the os calcis, which is rarely seen except as the result of industrial accidents and is followed by a large percentage of cripples, and these cripples are usually strong men in their youth or vigorous middle age. There are, of course, a few

¹ Transactions of the American Surgical Association, 1921, **39**, 752.

cases of this type of fracture that recover with a fairly good functional result, but they are cases in which there is very little displacement. A very large proportion, probably more than half, are partly disabled and permanently handicapped in their work, and Cotton says that one-third are totally disabled for real work. His article upon the treatment of recent fractures of the os calcis has been reviewed by us, and this paper is devoted to the consideration of old fractures. As a result of his method of impaction by lateral blows Cotton says he has not had any of his cases result in permanent disability. While he sees fewer recent cases each year, of late he is having referred to him more and more cripples who have been untreated or mistreated for this type of fracture. The os calcis is foreshortened, and flattened. This shortening beyond the loss of the "spring" results in little disability. Occasionally, there is a sharp outward deviation of the whole heel, resulting inevitably in flat feet, which cannot be relieved by support. Spurs on the plantar surface of the os calcis are not uncommon. The loss of some part of the lateral motion is a constant disability, and loss of all lateral motion is not rare. This limited motion is painful and disabling because of the resultant clumsiness. This loss of motion results from what Cotton calls a clogging of the posterior calcaneo-astragaloid joint, either from fracture across it, or from fracture displacing the unbroken joint surfaces or shortening the slide; or from new bone heaped up about the malleolus.

He advises correcting these causes of disability by operative measures.

Posterior Dislocation of the Foot. T. Turner Thomas¹ reports a series of 8 cases of this posterior dislocation of the foot, which we have reviewed during the last two years. It is a deformity which is far more common than is generally appreciated, and its improper treatment, or lack of treatment, inevitably results in an unnecessary and crippling disability. We reviewed a case that we had encountered last year and refer again to the subject in order to impress it upon general surgeons. It has long been held that there is a decided tendency in Pott's fracture for the foot to slip backward and sometimes so far that the body of the astragalus lies entirely behind the tibia. There is a roentgen-ray plate showing such a displacement in Stewart's *Manual of Surgery*. Quénu was probably the first to call attention to the fact that a posterior dislocation of the foot indicates the presence of a fracture of the posterior marginal surface of the tibia, as is shown in so many of Thomas' cases. Though it may occur without a posterior marginal fracture of the tibia, this probably is very rare. Thomas believes that this posterior marginal fracture of the tibia and the posterior dislocation of the foot are due to a force driving the foot upward and backward. Under general anesthesia he has obtained reduction by: (1) Traction on the foot, then forcible dorsal flexion, and (2) abduction or adduction, according to which, was necessary for the correction of the lateral deviation. Overcorrection is not likely to occur, but undercorrection is frequent. Tenotomy of the tendon of

¹ Surgery, Gynecology and Obstetrics, July, 1922, No. 1, 35, 98.

Achilles was performed in both cases reported by Downs and the reviewer, and, as a result, the correction of the deformity was very easily accomplished. Thomas concludes that:



FIG. 23.—The cases represented here by 1, 2, 3, 4 and 5, show in each instance, the lateral and antero-posterior views before and after the reduction of the displacements. In 6 we have both these views after reduction only, because none was taken before reduction. In 7 the patient refused to permit reduction and in 8 the antero-posterior views taken before and after reduction were lost. (Thomas.)

1. The posterior dislocation of the ankle, with fracture of the posterior tibial margin in Pott's fracture, has received little attention in this country. The dislocation has been generally attributed to relaxation of the ankle-joint, resulting from Pott's fracture.

2. The prognosis will depend largely upon the degree to which the reduction of the displacement has been accomplished and maintained during the development of bony union. Without reduction, the impairment of function must be serious. With reduction, the function has been essentially normal in all of his reduced cases, with the exception of the 2 recent ones which have not had sufficient time to recover.

3. The reduction should always be proven with the roentgen ray, and it should be maintained by a plaster cast because no other method would maintain the reduction satisfactorily. Moreover, for the same reason, the cast should not be removed until bony union is assured.

DELAYED AND NON-UNION OF FRACTURES. J. A. Nutter¹ speaks of delayed union from the sixth to the twelfth month and non-union after the twelfth month. General statistics seem to agree upon non-union in 2 to 3 per cent of cases, and that certain bones and certain localities are more predisposed to delayed and non-union, as the humerus between the middle and upper thirds, the femur at the middle third and the neck, and the tibia and fibula in their lower third. He makes the interesting observation that a substantial proportion of cases of delayed and non-union seen at the Buckston Hospital were found to be syphilitic, and to respond to antisyphilitic treatment.

This has been our personal experience in a surprising number of cases in the general surgical wards of several hospitals, and it is now a standing order that a Wassermann reaction be made at the time of admission upon every case with a fracture. We are certain that the unnecessary loss in hospital days, when this condition is overlooked, has been prevented in our hospital work by this routine procedure.

We also agree with his statement that general causes, such as nephritis and diseases of the ductless glands, are theoretical rather than practical. The local causes, although less numerous, are of greater importance. Interposition of soft tissues, incomplete immobilization, sepsis of virulence and duration sufficient to cause necrosis and sequestration, the use of metallic plates and screws, resulting in osteoporosis at the fragmentic ends. His treatment for delayed union is conservative. Baking, massage, hydrotherapy and the physiologic stimulus of function hastens union, especially in the lower limbs. For non-union in aseptic cases, he prefers bone-grafting.

Diagnosis of Bone and Joint Lesions by the Roentgen Ray. Baetjer² states that there are three age periods of bone: (1) The growing period, from one to twenty years; (2) the period of maximal health, from twenty to forty years; and (3) the period of decline, after forty years. Different lesions affect different age periods. Injuries to bone are according to the age of the bone. Take, for instance, the hip; in the first period fracture occurs at the epiphysis, which is the weakest part. In the second period the epiphysis is united to the neck of the femur and synovial membrane; the synovial membrane slips. In the third period, the bone is more brittle, owing to absorption of calcium salts, and

¹ Journal of Bone and Joint Surgery, 1922, 4, 104.

² Report of the Meeting of the Medical Society of the State of New York, April, 1922, Journal of the American Medical Association.

fracture of the neck of the femur occurs. In childhood the bones are much more flexible and green-stick fractures occur. In older people long, oblique fractures occur. In the elderly and aged, comminuted transverse fractures occur.

Disease of the bone is also in relation to age periods. The origin of the lesion is important. By determination of the origin, certain lesions can be ruled out. Bone lesions in children show three age periods: From one to three years, from three to six years and from six to fourteen years. In the first period the common diseases are scurvy, syphilis and rickets. From three to six years, tuberculous lesions of the joints are common. From six to fourteen years, Perthes's disease is often seen. There are also laws relating to sex: From one to five years, lesions are as common in girls as in boys. After six years, boys play more dangerous games and suffer a higher proportion of fractures. In men, the heavier trades show a larger percentage of bone lesions. After fifty years, the two sexes again become equal in this respect. In regard to neoplasms, carcinomatous metastases are more common in the female, following carcinoma of the breast. The most common cause of bone cancer in the male is carcinoma of the prostate, metastasizing into the pelvis and lumbar spine.

Extra-articular Tuberculosis of the Posterior Surface of the Patellar Apex. Jean¹ states that primary tuberculosis of the patella has been recognized for a long time, and more than 100 cases are found in the literature since 1888. The relative rarity of the condition is probably due to the slight vascularization of the bone. In the child an abscess tends to develop outside of the joint on the anterior surface of the bone; in the adult it tends to develop on the posterior surface. The author reports 2 cases. Both patients were adults, and in both the tubercular process developed on the posterior surface of the patellar apex. In the adult about one-fifth of the posterior surface of the patella in the region of the apex is connected with the anterior bursa of the joint and is, therefore, extra-articular. In the child under fourteen years of age the whole posterior surface is covered with cartilage. This explains the difference in the direction in which the abscess develops. Both of the author's cases were operated upon. In 1 case the patellar tendon was freed by lateral incisions and turned back, the osteitic areas in the posterior surface of the patella being curetted.

Tuberculosis of the Bone. Allison² reports a study of 50 cases of bone and joint tuberculosis. All cases in which there was any doubt regarding the diagnosis were eliminated. The localization of the infection was as follows: Spine, 3 cases; hip, 8; knee, 16; shoulders, 6; ankle and tarsus, 5; wrist, 1; elbow, 2; trochanter major, 1; trochanter minor, 1; tibia, 2; ulna, 1; humerus, 1; sternum, 1; malar bone, 1; rib, 1. The atypical localization in several cases might surprise one who had the conventional idea that the disease occurs only at certain points.

In most of the cases studied the joints were involved, and in every case there was involvement of bone. Allison believes that the disease

¹ *Rev. d'orthop.*, 1921, 3d s. 8, 393.

² *Archives of Surgery*, 1921, 2, 593.

is primarily a disease of the bone. Although it is not certain where the original infection occurred in all of the cases reviewed, it is certain that the bone became the chief seat of the process. No evidence was found of primary synovial involvement, and no case of pure tuberculous synovitis. There was abundant evidence, however, to show that a primary focus in the bone progresses to the joint and extra-articular tissues.

It is confusing to describe bone tuberculosis and joint tuberculosis separately. Both are the same process, the variations being due to the character of the tissues infected. The author suggests that, in teaching, the occurrence of tuberculosis in the shafts of bones be given more attention than is usually devoted to it.

The Problem of Growth Osteomyelitis of Adolescent Long Bones. Speed and Kellogg¹ point out that one of the serious and unfortunate results of acute osteomyelitis of adolescent bones is in the disturbance of their growth. Our knowledge of the bone growth at the present time rests upon very definite experimental work. Bidder,² by inserting needles into the epiphyseal cartilage plate of the long bones of dogs, found that which ever side of the cartilage plate was injured ceased growing. If the whole width of the cartilage plate was damaged, there was uniform hindrance of the longitudinal growth, the injured cartilage plate being replaced after such injury by connective tissue or bony trabeculae. Ollier, Haab, Vogt³ demonstrated experimentally that mechanical stimulation of the diaphysis near the epiphyseal cartilage plate increased the length of the bone. A temporary separation of the epiphysis and immediate replacement did not interfere with the growth, but when the cartilage plate was completely excised the growth of the bone stopped at once. Haas⁴ further demonstrated that the normal longitudinal growth of bone is also dependent upon sufficient blood supply to the region of the epiphyseal cartilage plate. This experimental evidence warrants our accepting the principle that the most important elements necessary for the longitudinal growth of bone are located in columns of cartilage of the epiphyseal plate and that (a) the nearer the injury comes to the cartilage columns, the greater is the growth disturbance; (b) there is also relation between the degree of destruction of cartilage columns and the loss of growth; (c) that disturbances of direct blood supply of the epiphyseal cartilage plate also have a marked hindering effect on the longitudinal growth of bone.

Acute inflammation of the bone, arising primarily in the epiphyseal area or spreading secondarily by continuity from the diaphysis, may cause destruction of the cartilage plate. The neighboring and immediate bloodvessels become blocked with thrombi and the epiphyseal arteries disappear. Less severe grades of infection, as exemplified by Schlatter's disease and Perth's disease, may cause complete or partial death of the cartilage plate without formation of pus, but the vascular

¹ Surgery, Gynecology and Obstetrics, April, 1922, No. 4, **34**, 469.

² Arch. f. exper. Path. u. Pharm., 1873, **1**, 248.

³ Arch. klin. Chir., 1878, **22**, 343.

⁴ American Journal of Orthopedic Surgery, 1917, **15**, 157, 305, 563.

supply may suffer just as much when the lesion resolves by round-cell infiltration and final fibrous tissue replacement. In these cases bone may grow across the epiphyseal area when the power of growth is completely obliterated. When the young growing epiphysis is thus destroyed and the action is rapid, the end-result after a few weeks is comparable to a mechanical destruction or excision of the cartilage plate. There will follow, therefore, all the phenomena occurring after experimental destruction or excision of the plate or destruction of its blood supply, namely, stoppage or uneven growth, depending upon the degree of obliteration. When the part involved concerns the limb containing but one bone, the loss of length may be compensated by skeletal readjustments and by extra growth of the remaining epiphysis in that bone. Where one bone of a pair, as in the forearm or the leg, ceases to grow from one of its epiphyses the uninterrupted growth of the other bone produces a deformity, the slower growing bone being pushed to one side.



FIG. 24

FIG. 25

FIG. 24.—Osteomyelitis of the lower end of the tibia following open fracture and resulting in stoppage of growth of the lower, least important tibial epiphysis. Note the fibula continues to grow and is causing a bowing deformity of the leg. The osteomyelitic focus is quiet and apparently healed.

FIG. 25.—Lateral view of the same leg as in Fig. 24, a slight drop foot is present. (Speed)

The three clinical conditions which produce the greatest destruction of the cartilaginous plate, by actual destruction or interference with its blood supply, are: (1) Fracture (epiphyseal separation); (2) inflammation (osteomyelitis or epiphysitis); (3) operative removal of a cartilage.

The practical application of these principles to the surgery of osteomyelitis in adolescent long bones Speed summarizes as follows:

1. Early operation on osteomyelitis of the shaft of long bone before

the epiphyseal areas become involved or their vessel thrombosed and obliterated. In the experience of the reviewer this cannot be too strongly emphasized. Radical operation and drainage of the medullary cavity in osteomyelitis is practically never performed early enough, even at the present time.

2. Extreme conservatism in draining acute suppurative epiphysitis of adolescent long bone. Very wisely Speed has explained this statement, which does not mean that we should be conservative in performing the operation of drainage, but that the operation should be conservative in its removal of the cartilaginous plate. Thus, he says that the periosteum should be opened by means of one longitudinal incision, and should not be reflected any more than necessary. That a sharp curette should never be used in the epiphyseal area, granulations being wiped out with gauze. He advocates the immobilization of the limb by splints and the application of traction in extension to prevent pathologic dislocation and permit of efficient drainage.

3. The parents should be warned of the possibility of growth interference and encouraged to have the patient frequently examined with roentgen ray after healing has taken place.

4. If the growth seems arrested, suitable splints or apparatus should be applied to prevent deformities while waiting for the growth to recommence. In the leg this means especially a provision against early weight-bearing without proper caliper support. From our experience, this is the most common error in the postoperative treatment of osteomyelitis at the present time. Over and over again cases are referred with a disabling deformity, resulting from lack of supportive splints* after a perfect surgical operation upon acute or chronic osteomyelitis. The orthopedists undoubtedly sin less frequently in this way than the general surgeon, and if the general surgeon attempts the surgical treatment of osteomyelitis he certainly opens himself to severe criticism if he does not give as much attention to the postoperative care as to the operation itself.

5. The skin over the growing ends of the healthy companion bone should be carefully protected so that pressure sores will not develop.

6. Remember the law of nutrient arteries in relation to growing long bones, *i. e.*, nutrient arteries are directed toward the elbow and from the knee, and the epiphysis, toward which the artery is directed, unites first. The fibula is an exception to this rule. Following this rule, the lower epiphysis of the femur, the upper epiphysis of tibia, the lower epiphysis of the radius and ulna, and the upper epiphysis of the humerus, are the last to unite in their respective bones, and therefore must be carefully guarded.

7. Unless a bowing deformity in the leg or forearm tends to manifest itself rapidly, and to cause great loss of function or threaten skin necrosis, the correction of the deformity by the use of splints should extend over a period of at least one year.

8. If both clinical and roentgen-ray examination during the course of the year show that the bone is arrested in growth, a resection of the shaft of the companion bone, remote from the epiphysis is performed

to equalize the length. The resected ends are held in apposition by kangaroo tendon.

9. If the child is young and many years, or inches, of growth are to be expected, the corresponding epiphysis of the accompanying bone may be excised in order to stop its overgrowth, provided a period of two or three years has elapsed, and it can be positively established that the epiphysis of the damaged bone has ceased all growth. After such treatment each bone grows at an equal rate from the remaining epiphysis and there is no possibility of a subsequent bowing deformity developing. Of course, a deformity in length will occur.

Chronic Bone Abscess. Brickner¹ has previously called attention to the fact that chronic abscesses of the medulla of long bones are often sterile, and that such abscesses can be promptly cured by simply evacuating them through a small opening in the bone. The recognition of such abscesses by roentgen ray is very uncertain. In his first report he said that they could not be so recognized, but in the last report he qualified this statement, and claims that when the abscess is surrounded by sclerosed bone the light area of the pus, sometimes by contrast, can be distinguished from the denser shadow of the bony wall.

The reviewer can personally testify to this uncertainty, and has found it to be the exception for the roentgenologist to diagnose these lesions preoperatively.

Brickner, after exposing the overlying cortex and by opening and retracting the periosteum, enters the abscess cavity with a $\frac{1}{4}$ -inch drill. With the escape of the pus, the drill is removed and nothing else is introduced into the bone; neither probe, curette or gauze packing. The culture is then made from the pus to determine what, if any, living organisms it contains. A smear is also stained and examined at once and, if many bacteria are found, the cavity should be enlarged and prepared for chemical sterilization. If but few or no organisms are found, a small drain of folded rubber dam is laid in the soft parts down to, but not into, the opening in the bone, and the remaining portion of the wound in the soft tissue closed by sutures. The purpose of the drain is to provide for any further escape of pus from the bone, and to act as a safety valve in case of possible suppuration in the bone cavity or soft parts caused by dormant organisms awakened to activity. This drain is removed and not replaced within three or four days, when the discharge should have practically ceased; the small opening in the soft parts is then allowed to close by granulation. The whole process, Brickner claims, is over in ten days, which is in marked contrast to the prolonged disability which results from wide-open osteotomy and healing by granulation.

Osteomyelitis of the Pelvic Bones. Geist² reports 6 cases of pyogenic staphylococcus infection of the pelvic bones. He refers to a compilation of Bergman of 35 cases in the literature. We reviewed, in 1921, Pfeiffer's report of a series of osteomyelitis at the University of Pennsylvania Hospital in which there were 2. In a group of 60 cases at the

¹ Surgery, Gynecology and Obstetrics, July, 1922, No. 1, 35, 84.

² Journal of the American Medical Association, 1921, 77, 1933.

Pennsylvania Hospital during the past three years there have been 3 cases of pyogenic osteomyelitis of the pelvic bones, 2 of the body of the ilium and 1 of the ramus of the pubis. The treatment in no way differs from that of pyogenic osteomyelitis in any other bone, namely, the earliest possible opening and draining of the medullary cavity to relieve tension. Geist says that in each one of his cases the roentgen-ray findings were positive and of great diagnostic aid. From our personal experience, and from the general attitude in surgical literature at the present time, this means that these operations were at a late stage of the disease, and when the process had advanced to the stage of necrosis. The time of election for operative treatment of osteomyelitis is weeks before necrosis is demonstrable with the roentgen ray. In one of our cases the diagnosis was confusing because the symptoms were all intra-abdominal during the first week and the nausea and vomiting, intestinal distention and diffuse, exquisite, generalized, abdominal pain justified the provisional diagnosis of peritonitis. Subsequently, we found that the infection was on the pelvic surface of the wing of the left innominate bone and was drained by trephining the bone from an external incision.

Syphilitic Backache. Thompson¹ states that syphilitic backache, although it is a rare condition, is probably frequently overlooked. Whitney,² in an examination of 544 syphilitics studied at the University of California Hospital, found 7 per cent with involvement of the spine. The most frequent sites apparently are the cervical and lumbar regions, over one-half of the reported cases affecting the cervical vertebræ. It is usually a tertiary manifestation. Pain is usually the chief symptom and it may be sudden in onset, like an acute focal infection, or gradual, extending over a long period of time. The pain is characteristically greatly intensified at night. Local tenderness is usually marked, and any attempted movements of the spine show increased rigidity and aggravate the pain. Whitney feels that it is pathognomonic of the condition that there is hypertonicity combined with a stiff spine. The pathology is similar to bone syphilis elsewhere—a simple periosteitis, an osteitis or a combination of both. Syphilis tends to new bone formation and the consequent nodules frequently make pressure on the nerve roots. Again, gummatous formations in the role of the bones may undergo liquefaction necrosis. Charcot's joints may involve the spine, although still a disputed question as to whether such joints are truly syphilitic or parasyphilitic, a similar symptomatology occurs.

The diagnosis of syphilitic backache necessitates the careful exclusion of all other factors producing backache, and the most liable to produce confusion are osteoarthritis of the spine from focal infection, tuberculosis, metastatic invasion of the spine from malignant tumors and typhoid spine. Infective arthritis usually involves many vertebræ, whereas syphilitic spondylitis is characterized by the limited number of vertebræ involved. Tuberculosis is perhaps the most confusing and, in the London Foundling Hospital, 70 supposedly tuberculous

¹ American Journal of the Medical Sciences, July, 1922, **164**, 109.

² Journal of the American Medical Association, 1916, **66**, 627.

cases gave positive Wassermanns and were cured by antisyphilitic treatment. The Wassermann test, of course, is of value only when positive.

A Case of Tabetic Charcot's Spine. Funsten¹ states that Charcot's spine is a comparatively rare condition. Charcot did not have a case in his series. Rotter,² in 1817, described 112 cases of Charcot's joints, none in the spine. As late as the twentieth century it was possible to collect only 15 cases from the literature, and only 1 of these occurred in America. The analysis of these cases, collected first by Jean Abadie, and summarized by Cornell,³ in 1902, gave the following statistics:



FIG. 26.—Roentgenogram, showing bony deposit. (Funsten.)

Syphilis was present in 6 cases, absent in 6, probable in 3. Sex: 11 males; 4 females. Age: 11 between fifty and sixty years; the youngest, 35; the oldest, 66. Ataxia: In 8 cases, extreme; in 6, moderate; in 1, slight. Other lesions occurred in 60 per cent.

Tabetic joints may occur at any stage in the development of the disease, although they seem to be more common in the preataxic stage.

¹ Journal of the American Medical Association, 1922, **78**, 333.

² Die Arthropathien bei Tabikern, Arch. f. klin. Chir., 1887, vol. **36**.

³ A Case of Tabetic Vertebral Osteoarthropathy, with Radiograph, Bulletin of the Johns Hopkins Hospital, 1920, **13**, 242-243.

In syringomyelia Charcot's joints develop at a late stage. It is rather characteristic that they develop rapidly, and it is interesting to note that in the present case the roentgenograms taken only nine months previously revealed nothing of the present condition, unless one concedes a direct progression of the osteoarthritic changes.

Existence and Treatment of So-called Epicondylitis.¹ The existence of epicondylitis in the true sense of the word is denied, as this condition has nothing whatever to do with the epicondyle. "Idiopathic" cases are usually the result of faulty or incomplete anamneses, and can be traced to excessive use of the humero-radial joint, especially in the flexed and supinated position of the forearm. The term "epicondylitis" should, therefore, be deleted from surgical nomenclature.

The basis of the clinical condition is an isolated capsular injury of the humero-radial joint. Clinically, there are two groups of cases: (1) Most of the cases are the result and expression of a chronic habitual occupational injury of the elbow (tennis, golf players and violinists), with the forearm simultaneously flexed and supinated. (2) A few cases are the direct result of a local and chronic trauma, which qualifies itself as an isolated sprain of the humero-radial joint. The pain is localized at the epicondyle, owing to the fact that the posterior branch of the radial nerve runs around the radial head.

Therapeutically, the chiselling off of the epicondyle for the relief of pain is needless and unjustified.² Alcohol injections are also useless. Hot air and rest—not immobilization—are the best treatment: The joint may be used in four to five weeks, although the patient should avoid supination and flexion, or lifting of heavy objects for sometime.

Infectious Arthritis of the Spine. Arthritis of the lumbar spine traceable to infections is a common cause of low back pain. The cases described by Epstein³ were characterized mostly by their mildness, by their ability to walk, by the involvement of the vertebræ and the peri-vertebral tissues, by the presence of lateral deviation of the spine and by the absence of sharp, angular kyphoses. Two of the patients have been previously treated for sciatica by means of massage and electricity; epidural injections have been done without success. They all complained of pain in the sacroiliac region and with striking frequency they were labelled sacroiliac slipping. The course was self-limited and several months was the average time lost from disability.

It is intended to omit any reference to gonorrheal, syphilitic or tabetic spines, as well as those of infancy and childhood. All Wassermann tests were negative.

In P. W. Nathan's paper on "Polyarthritis and Spondylitis," published in 1916, after an account of a series of experimental streptococcemias in dogs, he states: "It, therefore, becomes necessary to classify the spondylitides according to the presence or absence of neural symptoms, the mode of progression or the involvement of the ribs and joints of the extremities. Whether these structures are involved or not

¹ J. Dubs, *Deutsch. med. Wehnschr.*, May 19, 1921, **47**, 561.

² Tarnier: *Lyon Chir.*, 1921, **18**, 25.

³ *American Journal of the Medical Sciences*, August, 1922, p. 40.

is simply an accident of localization and does not depend upon peculiarities or essential differences in the etiology or the pathogenesis of the morbid process. It is, then, no longer necessary to specify by name the type of the spondylitis (Bechterew, Strumpell, Pierre Marie, etc.); these conditions are not essentially different; they are all simple variations in the location of some inflammatory condition which, like all inflammatory conditions, may be acute or chronic, transient or progressive, with or without permanent damage to the tissues involved."

The region of the back between the tenth dorsal level and the trochanters furnishes as much food for clinical study as the romantic area of the right upper quadrant of the abdomen. Heavy muscles cover the spine, rendering it difficult to palpate. These same muscles cause profound changes in symmetry of the entire trunk when their function is directly or indirectly impaired. The bony structures are complex in their arrangement and in close proximity to important nerve trunks, whose irritation in the presence of joint disease, may have far-reaching effects. As a result of the obscurity of some of these lesions, we behold queer diagnoses and questionable healing cults.

A definite list is due to osseous thickening and muscular spasm when we exclude evanescent cases of lumbago. It can be directly translated in terms of inflammatory exudates, adhesions, absorption of cartilages, destruction of bony tissue, deposits, excrescences and ankylosis. The process in acute severe cases is one of rapid softening of a vertebral lip, contraction or shortening of a meniscus, soon eventuating in a rounded lumbar kyphosis. Softening and destruction of one-half of the upper margin of the lumbar will most readily produce lateral deviation of the trunk. These changes may occur before they are recognizable in a roentgen-ray plate. A kypho-scoliosis coming on in the short space of a few weeks appears to be much more of a complicated mechanical process. It can be explained by a massive softening, destruction involving the lateral articulating processes, followed by a partial sliding of an entire vertebral body to one side. The usual phenomena of arthritis ankylostica follow and the organization of ligaments results in calcified bands of spondylitis deformans.

Ankylosis of bodies, the ideal process of resolution in inflammatory spinal disease, is "a consummation more devoutly to be wished" than an orthopedic operation designed to splint the spinous processes.

Treatment. The treatment of infectious arthritis of the spine is essentially mechanical. A plaster jacket and rest in bed are necessary to control symptoms during the acutely painful stage. To prevent deformity in certain cases, a Bradford frame may be used. Without immobilization, there is always a possibility of extension of the process. Braces are indicated for a more or less prolonged period to control recurrences.

Isolated Disease of the Scaphoid Bone of Foot. Risser¹ recalls that, in 1908, Koehler,² of Wiesbaden, reported 3 cases of disease of the scaphoid bone of the foot, occurring in children and limited to the scaphoid. Since then only 11 additional cases have been reported; so we may

¹ Journal of the American Medical Association, March 4, 1922, No. 9, vol. 78.

² München. med. Wehnschr., 1908, No. 37, vol. 55.

conclude that the condition is not very common. The disease is scarcely mentioned in the text-books of surgery or pathology. The etiology is obscure, though the clinical history, symptoms and course are fairly

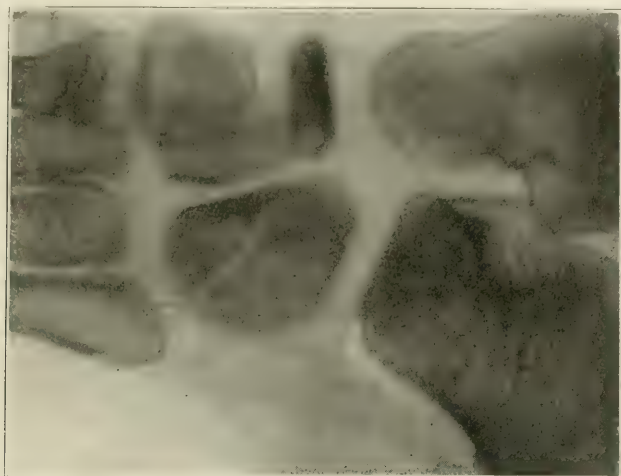


FIG. 27.—Diseased foot: Scaphoid narrowed, outline ragged, granular appearance. (Risser.)

uniform. The roentgen ray furnishes the only positive means of diagnosis. None of the cases reported have been fatal, and none of

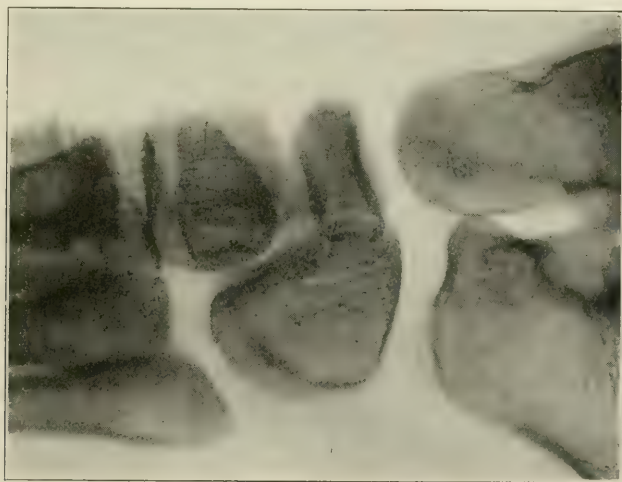


FIG. 28.—Diseased foot: Recovery advanced, scaphoid regaining normal size, shape and roentgen-ray appearance. (Risser.)

the patients have been operated upon, so that neither bacteriologic nor pathologic studies have been made. Hence, the roentgen ray furnishes the nearest approach to the study of the pathology of the disease.

The roengen-ray findings are fairly constant and typical, and coincide with the clinical course of the cases recorded.

Deforming Osteochondritis of the Upper Epiphysis of the Femur in Children. Perthes' disease—pseudocoxalgia; osteochondritis deformans; juvenile deforming osteochondritis of the hip; softening of the epiphyses; Calve-Legg-Perthes disease; coxa plana—has greatly interested and disturbed surgeons abroad and in this country during this year. No attempt has been made to review all the literature that has appeared, but its etiology, pathology and nomenclature are still under active discussion.

Calot and Colleu¹ explain the condition as a transient phase of congenital subluxation of the hip-joint. This congenital malformation of the hip-joint is responsible likewise for certain cases of arthritis deformans of the hip-joint, and certain other forms of hip-joint disease in adolescents and adults. All these apparently widely diverse affections are related to each other, the same as the chrysalis, the cocoon and the butterfly.

Weil² says it can be supposed that this deformity is caused by an intrauterine injury due to pressure. Just as this general injury may hinder the development of the total skeleton, a local limited pressure may lead to local disturbances of ossification.

Liek³ calls attention to the close analogy between the Legg-Calve-Perthes, Schlatter and Köhler affections, and the fact they affect only boys, as a rule, during the period of active growth. The bilateral, multiple occurrence points to a constitutional factor, and he ascribes it to some functional derangement of the epiphysis, which, in turn, he traces to the internal secretions. The epiphysis is not sound to start with. When slight changes exist there are merely "growing pains." When pronounced, there is softening of the epiphysis. Mechanical influences are an important factor, but the morbid changes in the epiphysis had preceded them.

Pseudocoxalgia. Platt⁴ regards it as a definite entity representing the reaction of the metaphyseal region of the upper end of the femur to the stimulus of an infective agent of attenuated virulence. The condition is comparable with the one seen solely in adolescents, and which represents the reaction of the hip-joint to an infective agent of a similar type. The whole cycle of radiographic changes is peculiar to pseudocoxalgia alone. They precede and outlast the clinical phenomena. The final picture is dominated by the deformation of the head of the femur, which is enlarged and flattened. The acetabulum in its final form can no longer contain the whole of the expanded head. Deformation of the head of the femur, with flattening and expansion, is seen also in conditions distinct from pseudocoxalgia during childhood. There is no evidence to show that in these conditions the typical structural osseous changes of pseudocoxalgia have preceded the stage of

¹ Presse médicale, Paris, p. 35.

² Centralbl. f. Chir., April 16, 1921, 48, 517.

³ Arch. f. klin. Chir., March 8, 1922, No. 2, vol. 119.

⁴ British Journal of Surgery, January, 1922, 9, 35.

flattening. At certain stages the clinical and radiographic pictures of the two groups of affections may show considerable resemblance. This applies particularly to cases of primary tuberculous osteomyelitis of the femoral neck. In the conditions known as tarsal scaphoiditis (Köhler's disease) and epiphysitis of the tibial tubercle (Osgood-Schlatter disease), bony changes parallel to those in pseudocoaxalgia are found. Conservative treatment directed toward the elimination of weight-bearing has no proven influence on the train of morbid changes, but its application is indicated during the stage of prominent symptoms. Operative treatment directed toward the removal of the dominant lesion has no present place in the therapeutics of this disease. The controversy over the nomenclature and the etiology of this condition increases, instead of diminishing, as time goes on. Calve¹ says that most of the observations published are incomplete and this probably is the cause of the confusion.

The subject is discussed at length by Lance and Capelle,² Pascal Feutelais,³ Vulliet⁴ and Chiasserini.⁵

Tumors of the Long Bones. Ashhurst,⁶ in a discussion before the American College of Surgeons, said that surgeons know a great deal about tumors in general and about sarcomata in particular, in the same way that there existed about syphilis an immense fund of information derived from clinical observation and study, long before the cause of that disease was known. Note, for instance, the many advances in our knowledge about tumors since the days of Virchow: (1) First perhaps should be placed the doctrine of anaplasia, as deduced by Hanseemann (1897); (2) then there is the classification of tumor cells according to their derivation from the primary embryonal layers, as totipotential, pluripotential and unipotential, for which, according to Adami, we are indebted to Barfurth; (3) then we have the doctrine of the equivalence of the connective tissues, endothelium, lymphatic, mucous and fatty, cartilage and bone marrow (Malherbe, 1904), which really is not in opposition with the doctrine of the specificity of tumor cells as taught by that genius of French pathologists, Bard (1899).

These, you will say, are mere theories; and it is true enough that they are mere theories, but after all are theories of no use? What would thinkers have done through so many years without the theory of gravitation? And yet we are now informed that this theory is false. But everyone must recognize, in the science of medicine as in the more exact sciences, that it is imperative to have theories of some kind on which to hang our ideas and by which to classify our thoughts. So it is for these purposes that Ashhurst ventures to think that the theories he has mentioned are still of use in surgery today.

It may be admitted that any cell in the body may give rise to a tumor. We know that some cells frequently give rise to tumors, as epithelial

¹ Journal of Orthopedic Surgery, 1921, **3**, 489.

² Jour. de Chir., 1921, **18**, 471.

³ Rev. d'orthop., Paris, July, 1921, **8**, 315.

⁴ Rev. méd. de la Suisse Romande, Geneva, July, 1921, **41**, 413.

⁵ Policlinico, Pract. Sect., Rome, October 17, 1921, **28**, 1394.

⁶ Surgery, Gynecology and Obstetrics, March, 1922, No. 3, vol. **34**.

and connective-tissue cells; we know that others very rarely, if ever, take on a neoplastic character. But actually there is scarcely any cell in the body from which some student does not think he has observed a tumor developing. For instance, that one recent investigator thinks he has discovered a tumor formed from erythrocytes (red blood cells). Though others may not agree with his conclusions, they must admit that in theory the thing is possible.

Now we may, with advantage, go one step further in our theorizing, and admit that every cell which may produce a tumor may produce a tumor of embryonal, of intermediate, or of adult type. The tumors of adult type, which were called by Virchow, and lately by C. P. White, histomata, are those which resemble (resemble, but do not actually reproduce) the normal tissues; those in which no formed tissues develop are named cytomata, and in them the cells remain of embryonal type forever, and these tumors are malignant. But, in accordance with the dictum, *Natura non facit saltus*, there must also be recognized tumors which are neither histomata nor yet cytomata, which are neither benign nor yet malignant, but intermediate in type. And these are the tumors which are the bane of the surgeon, for the pathologist merely replies, "I don't know," to all queries as to the prognosis as deduced from histologic study. Thus, it is easy to recognize the fibroma as a tumor of adult type derived from fibroblasts, and a spindle-cell sarcoma as a tumor in which the fibroblasts remain of embryonal type forever; but when some of the sections show fibrous tissue forming and others show cells of sarcomatous nature, it is impossible to say that the tumor is either strictly benign or decidedly malignant.

In the realm of bone tumors, particularly, are growths to be found about which no consensus of opinion exists among pathologists; and we have heard much about the malignancy of true osteogenic sarcoma and the benignancy, relative or absolute, of the giant-cell sarcoma, better called the myeloplaxoma of Eugene Nelaton (1860), or the myeloma of Malherbe (1904).

Now in regard to the term osteogenic sarcoma, this may be said: Osteogenic means bone-forming; and if a sarcoma in bone forms bone, the more bone it forms the more benign must the tumor be, because, according to the theory of anaplasia, the fibroblastic cells are developing to their adult type, and are forming a tissue. Either, therefore, the theory of anaplasia is wrong, or the term osteogenic is poorly chosen to describe a very malignant form of tumor. The most malignant form of tumor in bone should be one in which the embryonal type of bone cell was best preserved. Such tumors have for generations been called round-cell sarcomata; though some modern pathologists exclude all "small round-cell sarcomata" as being really of lymphatic and not of osseous origin, and consider all "large round-cell sarcomata" really to be composed of fibroblastic cells very immature in type.

But it need not surprise us to learn that many a tumor might grow in bone and yet have no pathogenetic relation to the bone proper. For there are all the marrow cells in bone, none of which has any neces-

sary relation to osseous tissue, and yet these cells do, according to some authorities, act as the focus of tumor formation. In some of the lower forms of life the marrow is not found within the bones (indeed these particular forms of life do not have any bones); but it is arranged as it were in glands which discharge their products into the blood stream, much as in the human body the secretions of the lymph glands are so discharged.

Now, the question of most interest to us is whether any of the forms of sarcoma of bone, as we understand that term, are tumors which arise from marrow cells (and these after all are connective-tissue cells), or whether we must confine the term sarcoma to tumors which are developed from osteoblasts and the derivatives of these latter. Is there not something lucid and simple in the theory of Malherbe about these sarcomatous tumors? Namely, that since the original indifferent connective-tissue cells may, in the course of their development, form either bone or marrow, or for the matter of that cartilage, lymphatic, endothelial or fatty tissues, so the adult type of tumor may conform to the type of any of these tissues, according to the manner in which the cell develops. Thus, he recognized the giant-cell sarcoma, which he named myeloma, as the adult (benign) tumor of bone marrow; and the embryonal (malignant) tumor of bone marrow, and named it myelosarcoma. Certainly we occasionally see also tumors of intermediate type in bone marrow which are neither certainly benign nor absolutely malignant. And though the adult types of fibroma, lymphoma and endothelioma are rare or unknown in bone, yet chondroma and osteoma (at least in the form of exostoses) are frequent; and we may with propriety name tumors of the intermediate type fibrosarcoma, chondrosarcoma or osteosarcoma, implying that some at least of the tumor cells develop sufficiently to give a tissue characteristic to the growth; while the purely sarcomatous tumors we may, perhaps, still be allowed to name accordingly to the predominant type of cell—round-cell sarcoma or spindle-cell sarcoma.

But these question of pathogenesis must, for the present, be left unsettled, until continued pathologic research sheds more light on the subject.

In regard to the question of conservative treatment of bone sarcoma, Ashhurst wrote nearly ten years ago: "The usual advice is to do amputation as early as possible, the limb being removed at the nearest joint above the disease. But to one who considers the ultimate results, it is questionable whether anything is gained by this but relief of pain. Internal metastases must often be present when the patient first comes to the surgeon, since they appear with such uniformity, even after removal of the limb; and local recurrence is so apt to follow excisions or amputation in continuity, that there is no class of cases so disheartening." These statements apply to undoubted sarcomata of bone. But even in what appear to be highly malignant forms of growth, he now believes it proper to incise the tumor and secure some tissue for microscopic study: If the diagnosis of great malignancy

is justified the exploration will do no harm; if it proves wrong, a life as well as a limb may be saved by proper treatment.

For the benign myeloma, he is firmly convinced that amputation is rarely justifiable. Evacuation of the tumor and complete removal of its contents, with crushing in of its walls if the tumor is small, or transplantation of bone if the tumor is large or if a pathologic fracture demands fixation, seems to him the method of choice. He is opposed to leaving to themselves, unexplored, what are thought to be benign tumors, because recovery will seldom take place without the aid of evacuation by the surgeon and if the tumor is of the intermediate type, prompt operation may prevent it from becoming malignant; and many of these benign tumors, especially in adults, have an undoubted tendency to undergo malignant change.

In tumors of the intermediate type he believes that a conservative operation (evacuation) should be first adopted; local radical excision is indicated for recurrences, or even amputation in cases where truly radical excision would leave a useless limb or endanger the life of the patient.

He is sure it is proper to employ Coley's mixed toxins in all forms of bone sarcoma. His own results speak for themselves; my own experience, though comparatively very limited, has taught me that their use may not only prevent, but actually cure, recurrences of tumors belonging to the intermediate type. As to radium, it appears to me that its true value has not yet been determined.

As regards the question of pathologic fractures, he does not regard it as of great importance. He has seen pathologic fracture in highly malignant sarcoma, and as the first sign of disease in osteomyelitis and in metastatic carcinoma, as well as in the benign bone cyst and in myeloma. It is a complication of the underlying disease, but does not alter the prognosis nor the indications for treatment.

There are so many questions still to be answered in connection with sarcoma of the long bones that it is well for us to acknowledge our ignorance and to plan means of increasing our knowledge. For is not life short while the Art is long? Is not the occasion fleeting, experience fallacious and judgment difficult?

Hemorrhagic Osteomyelitis. Barrie¹ publishes the same article which was reviewed in *Annals of Surgery* last year, to the effect that the picture presented in the primary phase of hemorrhagic osteomyelitis exhibits all the factors covering our conceptions of granulated tissue. Early efforts at repair in any non-suppurative area of osteolysis, exhibits a picture similar to the process termed hemorrhagic osteomyelitis, giant-cell sarcoma, giant-cell tumor. The same picture is noted in early efforts at bone repair after fracture. The solitary lesion has been seen and studied by him in all bones except the skull, clavicle, scapula and manubrium, and thus far only 1 case with multiple lesions in several bones has been observed.

Myerding² describes under the name of hemorrhagic cysts, very much

¹ American Journal of Surgery, September, 1921, **35**, 253.

² Surgical Clinics of North America, 1921, **1**, 1493.

the same condition as Barrie describes as hemorrhagic osteomyelitis. The cases which he describes occurred in the femur and are quite similar to one that has been under our observation for three years. It was a multilocular hemorrhagic cyst, involving the entire length of the medullary cavity of the femur. Although it had recurred after a previous operation one year before, no signs of recurrence have followed conservative operation of curettage.

Multiple Myeloma. Sverre Oftedal¹ states that multiple myeloma must still be classed among the rare diseases. According to Wallgren² there were, up to 1920, only 118 cases on record in which the diagnosis had been confirmed at necropsy. While the etiology is, to a great extent, obscure, some interesting evidences have been brought to light by observations on the reported cases. Harbitz,³ with the possibility in mind of its being a systemic disease of infectious origin, injected a series of animals with tumor substance, with negative results in all cases. Bradshaw⁴ reports a case in which the Bence-Jones protein was discovered in the urine more than a year before the appearance of any tumors. Based on this finding, he made a correct diagnosis of myeloma with its inevitable prognosis. This would seem to suggest an etiologic significance to the practically constant presence of the Bence-Jones protein in myeloma. Trauma has had an important role in the history of the reported cases. Sometimes, indeed, being of such a trivial nature as scarcely to be noticed by the patient at the time of its occurrence; the site of such trauma, however, in many cases having been the starting-point of a late tumor. The case here reported seems to be of interest not only from the standpoint of its rarity, but also because of the definite history of trauma, and a period of more than one year during which there was constant irritation of the rib surfaces by a hard rubber drainage tube.

Sarcoma of Long Bones. Meyerding⁵ reports that, in the Mayo Clinic from September, 1907, to September, 1921, 470 cases were diagnosed sarcoma of the extremities; 168 (35.7 per cent) of these were sarcoma of the long bones. One hundred and nine of the patients were operated on, and a microscopic diagnosis was made of sarcoma of the femur, tibia, fibula, humerus, radius and ulna. Besides the 470 cases, there were 18 in which a diagnosis of giant-cell tumor of the long bones was made at operation and from microscopic examination. Fifty-nine of the 168 patients were inoperable at the time of examination or they refused operation. In 85 of the 109 cases the sarcoma was in the lower extremity. It was in the femur in 49; in the tibia in 27; in the fibula in 9; in the humerus in 18; in the radius in 3; and in the ulna in 3. The left lower femur was involved in 27; the right in 22; the upper end of

¹ Journal of the American Medical Association, November 12, 1921.

² Untersuchungen über die Myelomkrankheit, Upsala Lakaref Forh, September, 1920, **25**, 113.

³ Multiple Primare Svulster i Bensystemet (Myelosarkomer), Norsk. Mag. f. Laegevidensk, May, 1903, **64**, 1.

⁴ On the Evolution of Myelopathic Albumosuria, British Medical Journal, July 13, 1901, **2**, 75.

⁵ Surgery, Gynecology and Obstetrics, March, 1922, No. 2, vol. **13**.

the left tibia in 17, and the right in 10. As to trauma causing bone tumor, Meyerding's experience leads him to believe that the single, hard, local injury is the type most often followed by sarcoma. Constant irritation causes traumatic periostitis, a more severe injury often causes a subperiosteal hematoma, which may undergo ossification rather than absorption. The principal points to be decided before operating are malignancy, metastasis and the extent of the bone involved. With early diagnosis, eradication of the tumor, care to exclude patients with metastasis, and the use of radium, roentgen ray and Coley's toxin, prolongation often may be looked for following operation.

Osteitis Fibrosis Cystica. A case of generalized cystic fibrous osteitis (von Recklinghausen) is reported by Floercken.¹ These characteristic lesions involve the right tibia, the trochanter of the right femur, the right radius and right ulna. The cyst in the tibia was removed and the wound healed. A year later there was a spontaneous fracture through the trochanter of the right femur. After another year there was pathologic fracture of the surgical neck of the left humerus. This cyst was drained, the cavity curetted and an osteoplastic strip from the tibia grafted into the fractured ends. A pathologic fracture occurred through a cyst in the left femur six months later. The question raised by Floercken is whether surgical treatment is ever justified in this hopeless condition, and after his experience he was inclined to the opinion that unbearable pain is the only indication for the opening of the cyst.

Bilateral Congenital Backward Dislocation of the Lower End of the Ulna. Holzberg² has reviewed the literature on this subject. According to Fosdick Jones,³ there were only 2 authentic cases on record up to the time of his writing (1911). However, there have been a number of cases of habitual dislocation of the ulna reported. We have had 1 case of bilateral dislocation this year, congenital in type. This condition was first recognized by Dessault in 1771.

The great majority of these cases were studied before there were any roentgen-ray opportunities. Most of these cases come to medical attention through a traumatic incidence. This occurred in the case herewith reported and served to call attention to the congenital condition.

None of the cases reported up to date lay stress on the importance of an enlarged styloid process, from an etiologic point of view. However, there were no roentgenograms reproduced with any of the reports which would bring out this point. Holzberg reports his case with illustrations, showing the congenitally enlarged styloid process to be responsible for the backward dislocation. This patient came to him with a history of trauma, and the true condition was not recognized at first.

Manipulations of Stiff Joints. We have learned to read carefully and take heed of advice offered by Jones,⁴ and his article on the manipulation

¹ Med. Klin, 1921, **17**, 1171; Surgery, Gynecology and Obstetrics, 1922, **34**, 213.

² Journal of the American Medical Association, December 24, 1921, No. 26, vol. **77**.

³ American Journal of Orthopedic Surgery, 1911, **9**, 199.

⁴ Journal of Orthopedic Surgery, 1921, **3**, 385.

of stiff joints is filled with those practical suggestions he is so well qualified to give.

When a painful joint is rigid in all directions, arthritis is present, but if it is rigid in certain directions only, and its movements in the other directions are normal, it is free from arthritis.

Intra-articular adhesions may be due to rupture of the joint capsule, hemorrhage or adhesive plications of the synovial membrane.

The Prevention of Adhesions. Following direct injury to a joint which does not cause fracture, movement should be begun immediately after the cessation of the acute symptoms, *i. e.*, when the swelling and tension pain disappeared. In children passive movements may be begun before active movements.

Breaking of Adhesions. Light adhesions may be broken under gas or gas and oxygen anesthesia. Complete anesthesia to obtain complete relaxation of the muscles is necessary if the adhesions are strong and resistant. The joint should be moved through the full anatomical range. The corresponding limb serves as a guide to determine the range of motion. If the adhesions are firm and resisting, the movements should be less complete, and full mobility should be secured by stages. After obtaining full motion, the limb should then be held in the position of full correction until the patient is able to make a voluntary effort. Voluntary movements should be begun as soon after the manipulation as possible, depending upon the severity of treatment and the reaction. If the range of motion is diminished after manipulation, the after-treatment has been defective or the manipulation ill-advised.

A fracture present near a joint should be protected by means of closely applied splints before manipulation is begun. Effusion in a joint after manipulation is strongly suggestive of the rupture of intra-articular adhesions, but this has no ill effects unless the effusion is accompanied or followed by a decrease in the range of movement. In such case the joint requires rest. The rupture of typical adhesions is audible and may be felt under the hand, but if the resistance is overcome by gradual stretching the prognosis is not so favorable. The joint should be kept in its new and corrected position at rest for a few days, and gentle passive movements then begun. Pain, which is sharp and of short duration, is negligible, but if it continues, increased stiffness is apt to follow, and rest is necessary.

Defects of the Patellar Border. Todd-McCally,¹ becoming interested in the large number of undiagnosed disabilities of the knee joint during their army experience began a study, on their return to civil life of the vast amount of material in the Hamman Museum with the especial purpose of discovering, if possible, some adequate cause of the disability. Since the history of the cases failed to give indubitable evidence of trauma and the condition did not, as a rule, result from ordinary activities in a young man's life, it seemed necessary to look for some slight lesion or some anomaly, as the result of the presence of which, repeated slight trauma regularly applied, such as that due to the continuous and some-

¹ Surgery, Gynecology and Obstetrics, July, 1922.

what monotonous action of the knee in a route march, might light up the condition.

There is a condition of the patella occurring in about 3 per cent of human beings characterized by more or less marked defect of the upper and outer part of the bone.

Certain minor defects which are ill-marked and show up best when lipping of the patella becomes a prominent feature are not included in the estimate of 3 per cent. These occur much more frequently.

The area in which patellar defect occurs presents certain differences from the remainder of the bone even in the cartilaginous condition. In the adult, lipping is exceedingly slow to make its appearance in this area. Pathologic conditions of the articular surface are prone to present themselves in this area.

The area to which reference has just been made is known as the area of emargination. It is associated with the attachment of the vastus lateralis tendon.

Patellar emargination may occur as a very slight defect. There may be a much larger defect in the bone, which may, or may not, be occupied by a separate ossification. Again, there may be incomplete separation of the patellar portions.

Associating with, or occurring in place of, patellar defect, there may be a condition of deep pitting of the articular surface.

No indication of recent or old callus formation is present on any of our specimens, whether of complete or incomplete separation of the patellar portions.

No indications of inflammatory processes occur in relation to either patellar defect or excavation.

Lipping of the margins of the emarginate area occurs with age; this must not be mistaken for callus formation.

A history of trauma is not given by the cases in which patellar defect is found.

The condition occurs on both sides twice as frequently as upon one side.

There is no convincing evidence that the condition occurs more frequently with increasing age.

They have been able to present all phases of the development of the condition, although the results of their investigations upon children are unsatisfactory.

There is no doubt that the patella sometimes ossifies from separate centers in the vertical axis. They have presented specimens showing the probability of other centers of ossification in individual instances.

As the result of the findings just summarized, they believe that the condition is an anomaly and not a fracture.

Chronic Infectious Arthritis. Billings, Coleman and Hibbs¹ state that the management and treatment of this group of patients was based on the principles that relate to the cause, mode of infection, and the character, of the morbid anatomic changes. Primarily, this involved

¹ Journal of the American Medical Association, April 15, 1922, No. 15, vol. 78.

the location and eradication of the apparent etiologic focus of infection. The location of the real focus of infection was difficult occasionally, and at times impossible. The diagnosis and location of the primary focus sometimes required the highest clinical skill and the coöperation of qualified specialists, laboratory investigation and the use of diagnostic instruments of precision, including the roentgen ray. In some patients the failure to eradicate completely the etiologic focus by surgical measures defeated the subsequent management and treatment.

The clinical investigation confirms and substantiates the present point of view of a majority of clinicians who have had the opportunity to make a careful investigation of chronic deforming arthritis, that it is primarily an infectious disease, and that the infectious microorganisms which are the cause are usually strains of non-hemolytic streptococci of relatively low virulence, or occasionally strains of non-pyogenic gonococci or even of other bacteria of mild pathogenicity.

The cause of the remarkable transformation of the fibrous tissues which enter into the joint structure and also of the muscle tendons, into bone, is an interesting subject for future investigation. If the remarkable results of the animal experiments reported by Oxhausen¹ can be substantiated, it may be possible to apply preventive measures which will obviate these disabling irremediable secondary morbid changes.

Synovial Cysts and Tuberculosis. Polycystic Tuberculous Disease of the Wrist. Positive Inoculations of Guinea-pigs with Cyst Fluid. Various theories have been held concerning the pathogenesis and etiology of cysts about the wrist joint. Several authors have shown the importance of tuberculosis in this connection, this disease existing under some form in the patients themselves or their immediate family, in several cases reported. Gougerot's² case is the first where inoculation of a guinea-pig with the cyst fluid gave positive results.

These synovial cysts belong, therefore, to a general category of serous membranes which become tubercular. That all cysts of the wrist are tuberculous is not true. Except in the case of very small cysts, excision is usually necessary, followed by immobilization of the wrist in a small plaster for about fifteen days. After this a leather supporting bandage is advisable.

Deltoid Paralysis and Arthrodesis of the Shoulder-joint. Straub³ states that the picture of this lesion, which is a rather rare object for treatment by the surgeon, is a lamentable one: The changed contour of the shoulder, undue prominence of the acromion, coracoid and head of humerus, the subluxation of the joint, inward rotation of the arm, the flail shoulder, with the limb practically a useless appendage of the body. Though the function of the forearm and hand may be entirely preserved, they are rendered useless in this condition through the inability of the patient to move them to the desired place of action.

While medical and mechanical treatment may be indicated in recent or partial deltoid paralysis, it is the inveterate case which usually

¹ Verhandl. deutsch. Gesellsch. f. Chir., 1912, **62**, 40.

² Paris médicale, October 29, 1921, **11**, 333.

³ Surgery, Gynecology and Obstetrics, April, 1922, No. 4, **34**, 476.

applies to the surgeon and it is a new method suggested by Straub that we wish to present at this time. His object is to obtain a bony fusion of the joint. After exposing the joint by a four-inch incision carried from a point half an inch internal to the acromial clavicular joint downward to the outer side of the pectoro-deltoid groove, the joint is opened alongside of, and internal to, the biceps tendon. The tendon is then lifted out of the sulcus between the tubercle and is placed laterally. The capsule is then dissected off the anatomical neck and the head of the humerus can be conveniently dislocated, when the synovial membrane is excised as thoroughly as possible. The cartilage of the dislocated head of the humerus is then excised down to the cancellous tissue and

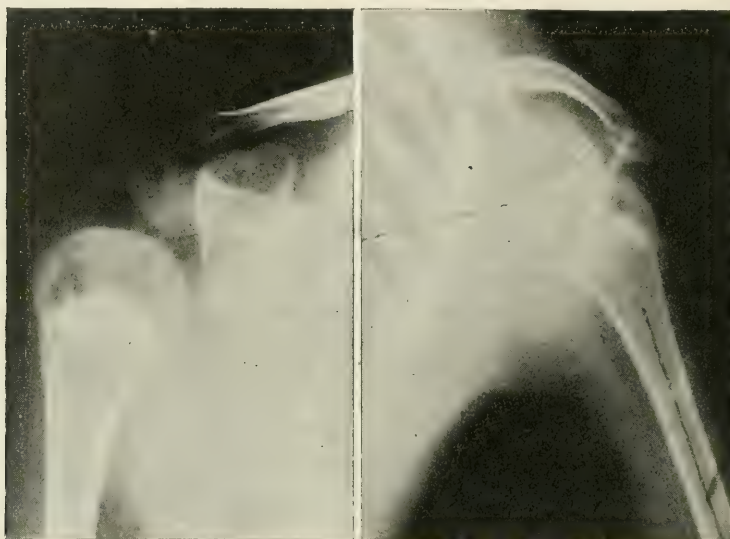


FIG. 29

FIG. 30

FIG. 29.—Ante-operative roentgenogram, showing subluxation of shoulder joint. (Straub.)

FIG. 30.—Postoperative (twelve weeks) roentgenogram of shoulder joint, the humerus is firmly united to the scapula, the bony fusion in the glenoid fossa is shown, the osteogenetic process is creeping up along the bone peg. The angle made by the outer edge of the scapula and the humerus is slightly more than 90 degrees. (Straub.)

in a like manner the cartilage is removed from the glenoid cavity, care being taken to preserve the insertion of the biceps tendon. With the scapula fixed in its normal position, the head of the humerus is returned into the capsule and closely approximated to the glenoid cavity and the acromion. In order to insure for the patient the most use of his hand, the humerus should be ankylosed at about a right angle abduction to the body (the external border of the scapula forming an angle of 80 to 110 degrees with the axis of the humerus). This is the position by which the hand can reach the mouth, head and neck and also the upper arm will comfortably touch the lateral chest wall in the position of rest. With the arm in this position, a hole is drilled through the acromion into

the center of the head of the humerus, the drill being left in place while a small dowel-peg is secured from the tibia, and then the drill is removed and driven into the hole. The smooth intertrochanteric groove for a distance of about one inch is converted into a rough bony trough by lifting up the periosteum and under the periosteal flap the biceps tendon is buried and the periosteum united by kangaroo tendon sutures. The parts are immobilized by plaster for twelve weeks.

Intrinsic Derangement of the Knee-joint. Henderson¹ justifies the distrust of the knee as a proper field of surgery by the crippling disability of ankylosis or amputation which follows infection and the living latent example of surgical disaster such a patient presents in contrast to those who die from peritonitis following a clean abdominal operation. But our war experience, and especially the mobilization treatment of infected joints as advocated by Willems, has demonstrated that infection in surgery of the knee-joint can be controlled as elsewhere, and that there is no more need for fear of exploring this field than the exploration of any other closed serous cavity of the body.

The semilunar cartilages rank first as a cause of mechanical derangements of the knee. The English literature contains many reports, notably by Rutherford Morison and Sir Robert Jones, of large series of patients operated on, but the American literature is scanty. This can be explained, partly at least, by the fact that games, such as rugby and soccer, are participated in by a much larger number of persons than in America, and also by the fact that in the mines in the region of Newcastle, where the condition is very common among the miners, the workers labor in low seams, which makes it necessary for them to squat on their heels with knees flexed and feet everted, a most favorable position for damage to the menisci. The fact that the internal cartilage is more often damaged than the external can be explained by anatomic facts. The internal cartilage is so firmly attached to the internal capsule that when caught between the bones, if the force continues, the cartilage will tear or fracture before it is torn from its moorings.

Rutherford Morison has described in detail many types of fractures, but the so-called "bucket-handle" is probably the most common. This specific tear is a longitudinal rip in the middle portion of the internal cartilage, leaving the torn area attached at the anterior and posterior ends, the loop thus formed slipping into the intercondylar notch. Full extension is thereby prevented and the joint locked in slight flexion. A definite pathological condition, as evidenced by a tear or fracture, is almost invariably present when the derangement is due to the internal cartilage.

The external semilunar cartilage at its periphery is loosely attached to the capsule and this fact permits the meniscus a certain mobility and allows it to glide out of harm's way. If it is the cause of the derangement, it usually is found crumpled up rather than torn, and is more apt to prevent flexion than to limit extension. The condition is usually a loose, rather than a torn, cartilage.

¹ Surgery, Gynecology and Obstetrics, May, 1922, No. 5, 34, 681.

The primary derangement should be treated conservatively but repeated lockings, with periods of disability, make it necessary to resort to surgery. The roentgen ray is of no value, as these fibrocartilaginous menisci cast no shadows. The procedure of injecting the joint with oxygen, thus throwing the fibrocartilages in relief, is too dangerous a procedure to warrant its use.

Loose osteocartilaginous bodies are also a cause of mechanical derangement of the knee, but the symptoms are more transient and the disability less than when the menisci are at fault. In numbers, they range from one or two up into the hundreds. Usually, the patient has palpated them and often is able to force them out where the surgeon can also feel them. They are readily shown by the roentgen ray. Not infrequently both joints are involved. They are of chief interest from the viewpoint of etiology. As a primary promise, it may be accepted that trauma, direct or indirect, is a factor, but not the sole factor in their production. They may be grouped under three divisions. They may arise from the internal condyle just anterior to the insertion of the posterior ligament. A satisfactory explanation of this peculiar condition, seen only in the knee joint, has not been advanced, but Koenig, in 1887, offered the theory that it was due to blockage of an end-artery and called the condition "osteochondritis dessicans." They may arise incidental to osteoarthritis. The marginal osteophytes or ecchondroses become chipped off and wander freely about the joint cavity and increase in size, obtaining their nourishment from the joint fluid. Occasionally, the synovial membrane undergoes a peculiar change, becoming thick and pleated, forming bulbs, which become osteocartilaginous on the tips, and, as they increase in size, drop off and migrate as free bodies. They take nourishment from the joint fluid, further increase in size, and may be so numerous that in palpating the knee, one is reminded of a sac of marbles. This condition is called "osteochondromatosis," and is not confined to the knee joint, but may be found in the elbow or shoulder joint. It suggests in some ways a benign neoplasm. Osteocartilaginous bodies rarely arise from the tibia or patella. Loose foreign bodies of extrinsic origin are of very rare occurrence in civil practice.

The incisions to be used in the removal of the causes of mechanical derangement are of importance because the joint cavity is not easily explored. When one of the semilunar cartilages is to be removed, either the internal, antero-lateral or the external, antero-lateral are to be preferred to any other. When a thorough search of the anterior compartment of the knee joint is to be made, the longitudinal split patella incision is the incision of choice. When the bodies to be removed are in the posterior compartment, the posterior, internal lateral or the posterior, external lateral incisions made with the knee flexed to a right angle afford ready access to a rather inaccessible region and even a fair degree of opportunity for visual inspection.

Postero-lateral Incision for the Removal of Loose Bodies from the Posterior Compartment of the Knee-joint. Henderson¹ recalls that the posterior

¹ Surgery, Gynecology and Obstetrics, 1922, 24, 6.

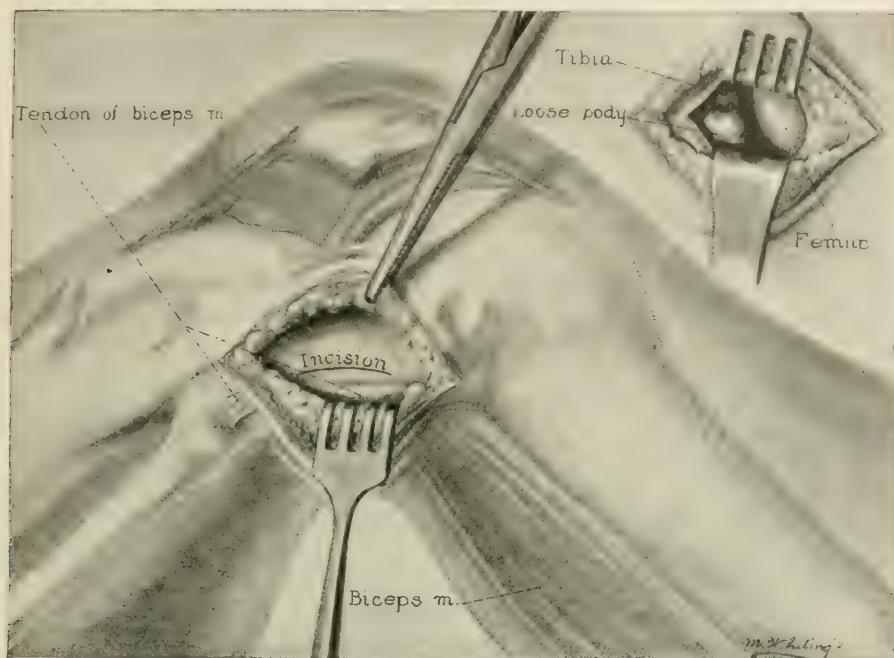


FIG. 31.—External postero-lateral incision. Insert shows loose body. (Henderson.)

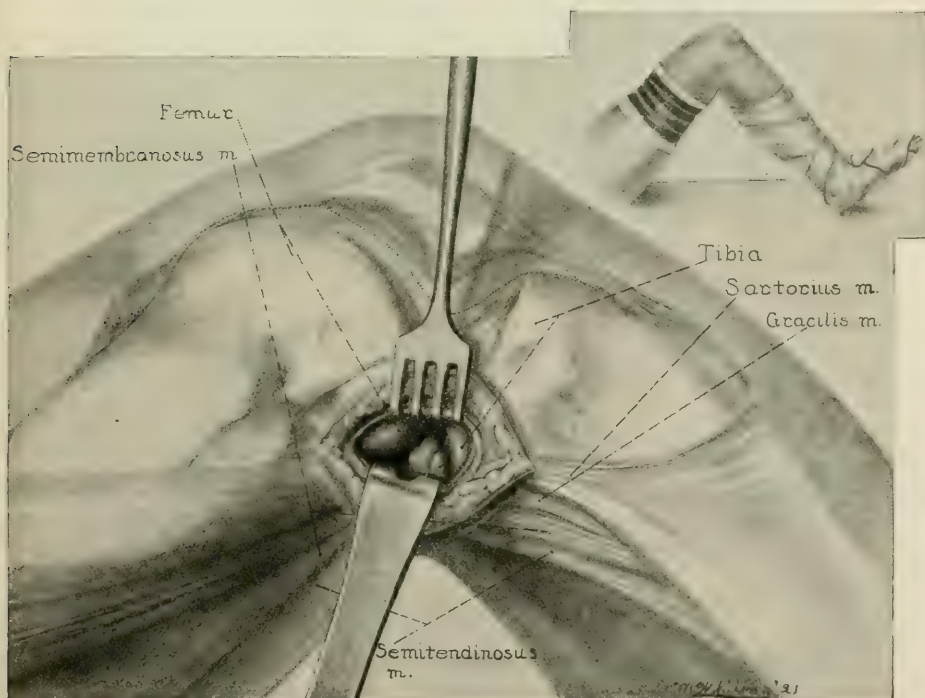


FIG. 32.—Internal postero-lateral incision. Insert shows knee flexed to the right angle, and the position of the leg on the operating table. (Henderson.)

compartment of the knee-joint is practically divided by a mesial septum into internal posterior and external posterior compartments. A postero-lateral incision is therefore often necessary on both sides, in order that the exploration for the bodies may be completed, but both incisions are small and practically no dissection is needed.

The knee is flexed to a right angle, thus relaxing its posterior capsule. If the loose bodies are all in the outer division of the posterior compartment, the incision should be made posteriorly, well on the outer side but in front of the fibula (Fig. 31). A semilunar incision, with the convexity anteriorly or posteriorly, may be made in the skin, and a straight incision parallel with the longitudinal axis of the leg made in the capsule. This may be enlarged, and retractors placed to give an excellent view of the posterior cavity of the joint. A large curette or gall-stone scoop may be used to explore and remove the loose bodies. The mesial septum prevents ready access to the inner compartment, and, if exploration on that side is necessary, rather than to cause trauma to the interior of the joint by forcing an instrument through it, an incision similar to the one just described should be made on the inner side. This is anterior to the relaxed tendons of the semitendinosus, semimembranosus, sartorius, and gracilis muscles.

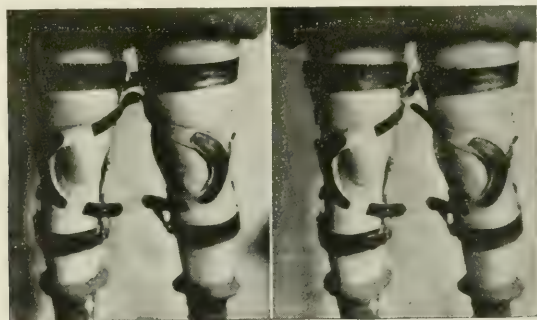


FIG. 33.—Jones' knee brace with pad attached. (MacAusland and Sargeant.)

Recurrent Dislocation of the Patella. MacAusland and Sargeant¹ state that this condition is a lesion peculiar to young girls during their period of growth and apparently tends to persist into adult life. The first displacement usually occurs between the twelfth and the eighteenth year and is, as would be expected, more painful than subsequent ones. Knock-knees are probably the chief predisposing factor, while injury is the direct cause. Anatomically, the most frequent lesions which contribute to the condition are the lateral attachment of the tendon and faulty development of the external condyle of the femur. The trauma which usually produces it consists in an inward twisting at the knee combined with a blow or pressure on the outer side of the leg, and associated with these factors is always a sudden strong contraction of the

¹ Surgery, Gynecology and Obstetrics, July, 1922, No. 1, 35, 35.

quadriceps muscle. The diagnosis, of course, is made by the flexion of the knee and the displacement of the patella to the outer side of the condyle, and the exact position of the patella is determined by the roentgen-ray. MacAusland and Sargent outline the treatment for the acute and chronic luxations.

(a) *Acute Dislocation.* The bone can be easily reduced by sudden extension of the leg with pressure of one hand against the outer condyle of the femur and then pushing the patella toward the medium line. The joints should then be immobilized with plaster for at least three weeks and they think that if this was done more frequently after the original injury there would not be so many recurrences.

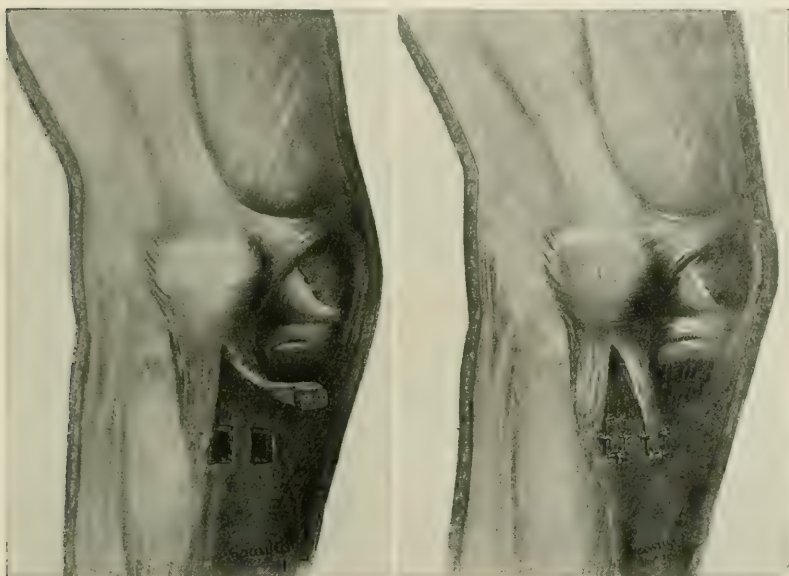


FIG. 34.—Showing method of transplanting bony insertion of patella tendon. (MacAusland and Sargeant.)

(b) *Recurrent Dislocations.* They describe four lines of treatment which may be grouped into (1) supportive; (2) stimulative; (3) correction of static errors; (4) operative.

1. The supportive treatment in the earlier attacks gives the patient confidence. A split knee-cap with a crescentic pressure pad to aid in holding the patella in place, or a Jones knee brace, are indicated.

2. The stimulative treatment consists in baking and massage and appropriate exercises to strengthen the muscles and ligaments and develop postural strength.

3. The correction of static errors is most important. In many of these cases there is marked abduction of the feet and the correction of this deformity counteracts in a mild degree a moderate knock-knee.

4. Of the operative methods, capsulorrhaphy alone has been a distinct

failure and in the 16 cases they have operated upon they have found that a transplantation of a part of the patella tendon has been, in all cases, followed by good results. The technic which they advise is essentially a transplantation of one-half of the patella tendon with its bony insertion.

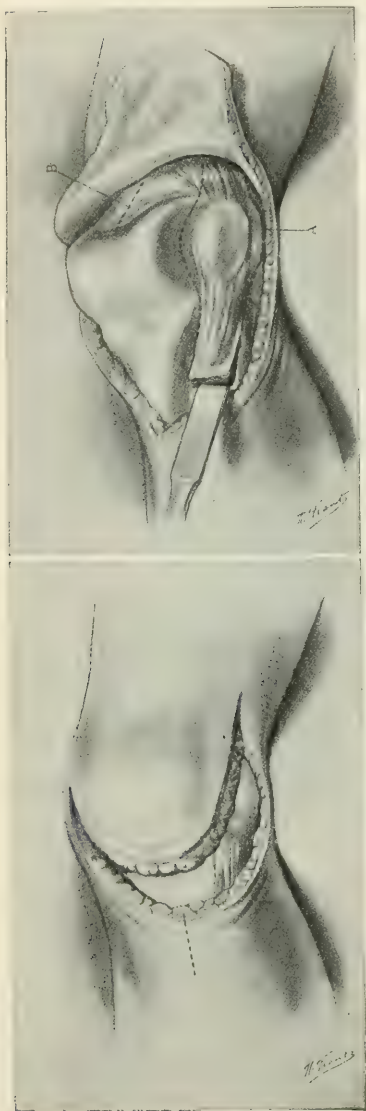


FIG. 35

FIG. 35.—Complete congenital luxation of the patella (left side). Curved cutaneous incision with concavity upward extending higher on the external side. Dotted line indicates the vertical incision to be made from the summit of the curved incision to expose the anterior tuberosity of the tibia.

FIG. 36

FIG. 36.—The anterior tuberosity of the tibia is detached with the chisel and the patellar ligament and its folds and the tendon of the quadriceps muscle are detached by two lateral incisions (dotted lines) to above the base of the knee. B, the incision of the anterior fibrous sheath which overlaps the femoral condyles.



FIG. 37

FIG. 37.—Through a buttonhole incision the freed patellar tissues are seized with the forceps.

FIG. 38

FIG. 38.—The edges of the buttonhole incision are pulled through the buttonhole incision. The edges of the

Through a curved incision made over the inner side of the patella, the tendon is exposed. An incision through the center of the patella tendon from the lower edge of the patella to the tubercle is then made. A wedge of bone about 1 cm. square is then removed from the tibia, which includes the attachment of the inner half of this divided patella

tendon. A similar symmetrical bony wedge is removed from the inner surface of the tibia to the inner side of the first wedge and at a point where the transposed end of the split patella is to be reinserted. The bony transplant with the attached patella tendon is forcibly wedged into its new bed and the button of bone then placed in the hole remaining after the removal of the bony insertion of the tendon.

Mouchet and Durand¹ report a bilateral dislocation, and describe an operation differing slightly from that of MacAusland's.

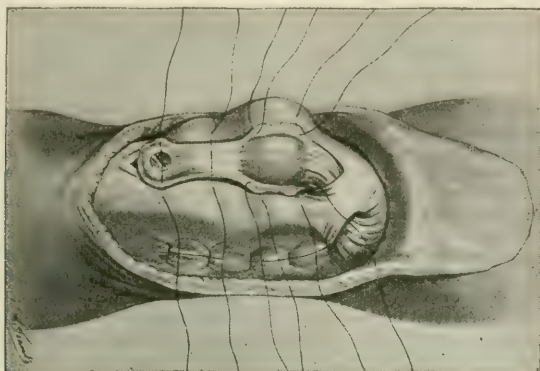


FIG. 39.—Interrupted sutures fixing the patellar structures in their new position.

Treatment of Septic Knee-joints. During the last year the literature has contained more and more favorable references of the Willems treatment of infected knee-joints. Weatherbe² reports his experience and believes with so many others that this method of treatment apparently gives the best prognosis as regards both life and function. There are, however, a few men who still are unconvinced. Ober³ reports an experience based upon 100 war cases in which he tried to point out the limitations of the treatment by mobilization. The limitations seem to us to be more like excuses, and to say that a contraindication is that it must be entrusted only to well trained nurses and orderlies, is rather an indication that the surgeon should provide adequate care for such a serious condition.

Results of Extensive Knee Resections in War Surgery. Before the war it was generally believed that amputation was preferable to a resection of the knee which shortened the limb more than 10 cm. During the war, however, resections of this kind were common, and the final results in many cases of extensive knee resection were studied by Patel.⁴

He traced 19 patients on whom he performed resections of the knee for war wounds in 1917 and 1918. In each case the resection exceeded 8 cm. Three of these patients died later from influenza. Of the remaining 16, 3 subsequently had a secondary amputation and 13 have recovered.

¹ Jour. de Chir., 1921, **18**, 225.

² Lancet, 1921, **201**, 1271.

³ Journal of Orthopedic Surgery, 1921, n. s., **3**, 689.

⁴ Bull. et mém. Soc. de Chir. de Paris, 1921, **67**, 619.

In 2 cases the shortening is 8 cm.; in 1, 9.5 cm.; in 1, 11.5 cm.; in 3, 12 cm.; and in 4, 14 to 18 cm. These patients are unable to walk without the aid of prosthetic appliances. The cases in which extensive resections were done were principally infected articular fractures or knee resections followed by non-union and sepsis.

Roentgen-ray examination some months after union in cases of resection of the knee reveals interesting anatomical changes; the tibial end is thickened and the femur shows bone stalactites and is ensheathed by two lateral bony projections which suggest two femoral condyles grafted to the upper extremity of the tibia. A most remarkable bone adaptation results which assures solidity of the new ankylosis and constitutes further proof that in a young person the osseous system is constantly changing and that when infection is arrested osteogenesis continues.

Roentgenographs taken two years or more later show complete fusion of the two bones, the femoro-tibial mass being thickened throughout its entire extent. This is the end-result.

Antero-lateral Luxation of the Vertebral Column Reduced by Operation. Constantini and Duboucher¹ report a case of a man, aged forty-five years, whose spine was injured in an automobile accident. The roentgen ray showed the following deformities. (1) Right antero-lateral luxation of the second dorsal vertebra on the third. (2) Overriding of the lower articular processes of the second lumbar vertebra on the pedicle of the third. (3) Downward displacement of the right part of the body of the third lumbar vertebra which was more marked in its anterior portion. (4) Fracture of the transverse processes of the second and third lumbar vertebrae on the left side, opposite the lateral luxation of the body of the second lumbar vertebra. After unsuccessfully attempting to reduce the luxation by suspension and traction, they were able to replace them by an open operation. It is this kind of problem which one cannot help wishing to submit to the so-called osteopaths and chiropractors who claim such miraculous ability in replacing imaginary, or at least undemonstratable, subluxations.

Flat-foot and Rheumatism.² Attention is again called to the careless and not infrequent diagnosis of rheumatism for pains in various portions of the body associated with tendons, muscles or nerve trunks. In rare instances this may be a correct diagnosis in the sense that these pains are due to the deposition in these portions of the body of the products of impaired metabolic processes, and probably the term "rheumatism" is just as accurate as would be the term "lithemia" or "gout." All too frequently, however, the condition is not one dependent upon perverted metabolism, but results from some fault in ligamentous or bony structure whereby stresses and strains are induced which are the real cause of the suffering.

Sciatica is not as common a diagnosis today as it used to be, now that pathologic conditions in the hip-joint and in the sacroiliac joint are better recognized, and pains in the legs and feet are frequently the

¹ Rev. d'orthop., 1922, **29**, 27.

² Therapeutic Gazette, December 15, 1921, No. 12, **45**, 857.

result of flat-foot or faulty position of the ankle-joint particularly in persons who, with advancing age, gain greatly in weight and whose bony and ligamentous structures are, therefore, subjected to an amount of strain which they escape in earlier years.

In other cases, pain does not develop, but the feet and ankles become somewhat swollen, developing a true edema which will pit on pressure, or a puffiness which will not pit, somewhat resembling a condition in the horse which veterinarians call "wind-gall," which condition leads the physician to suspect some cardiac or renal disturbance, yet a careful examination will fail to reveal any feebleness of the heart or any abnormality in the urine. Upon the patient reducing weight, or upon the use of properly made shoes or supports for the parts which are under strain, the puffiness to which we have referred disappears.

It is noteworthy that in all the cases which we have described most of the remedies employed, which are intended for a rheumatic or gouty diathesis, utterly fail, although the salicylates may for a time seem to be successful in that they tend to relieve pain, and this temporary success often still further misleads the physician as to his diagnosis.

It is not to be forgotten, on the other hand, that some persons who have flat-foot or a turned ankle suffer from no pain whatever, and again there is a third class in which these weaknesses or deformities are present and are entirely free from pain at times and then suffer from severe attacks of it, because in these patients a combination of stress and strain with a gouty diathesis results in the strained parts suffering from both stress and gouty deposit. In such cases adequate support to correct the weakness or deformity, regulation of the diet, and the employment of the salicylates or other drugs belonging to this class, prove successful.

THERAPEUTIC REFERENDUM.

By H. R. M. LANDIS, M.D.

Acacia. During the war the intravenous use of acacia for transfusion was advocated as a means of supplanting blood transfusion which was not always available. It was sponsored principally by Bayliss. At present its value is a matter of dispute. Accidents have been reported and, in addition, there is a lack of agreement as to its beneficial effects among surgeons who have used it. Furthermore, there is some experimental evidence reported as to its harmful effects. Several investigators have shown that it may do harm in several ways. It may produce agglutination, both intravenously and outside the body. It may cause pulmonary emboli, accompanied by symptoms resembling those of anaphylaxis. It may, on the other hand, interfere with the normal coagulation of the blood, and so be harmful by discouraging hemostasis.

Bayliss¹ has written an article in defense of the procedure. He points out that, at the end of the war 75 liters a day were being supplied to the British Army in France, and that just after the Armistice a conference of consulting surgeons and others was called in order to discuss the use of acacia solution. It was agreed that no harm was to be apprehended from the proper use, while stress was laid on the importance of the purity of the acacia and the method of preparation.

Bayliss refers to an unfavorable experience which the British Army had in Italy. A sample of the acacia used was found to leave a large, dirty, insoluble deposit. This, when placed in solution, was found to be quite useless when tested on cats.

An editorial criticism² concludes that experience with the procedure has not been sufficiently long for a thorough appraisal of its use as a therapeutic remedy.

Henderson and Haggard³ believe that the most important factor in a case of serious hemorrhage is the acapnia produced by a deficiency in the number of blood corpuscles rather than the fall of blood-pressure following a decrease in blood volume. Replacement of the blood with gum, in their experiments, did not relieve the air hunger and its attendant muscular exertion and overventilation. Life was, therefore, only prolonged and not preserved. In commenting on the work of Henderson and Haggard, Hare states that it rests with the advocates of gum infusion to bring forward more evidence of the clinical efficiency of this substitute for the physiologic remedy.

¹ Journal of the American Medical Association, June 17, 1922.

² Ibid.

³ Abstract, Therapeutic Gazette, July, 1922, p. 495.

Lee¹ reports 2 deaths following the intravenous injections of acacia. He states that both patients presented symptoms which are claimed to be indications for the use of acacia. Neither patient was moribund, and there was no reason to believe that both patients could not have survived the time period during which death occurred had not acacia been injected.

The acacia was of the usual variety; the solution was freshly prepared, neutralized and filtered according to the directions of Bayliss. In Lee's opinion the main difficulty is not with the making of the solution, but with what happens when the acacia is introduced into the circulation. From his experience, Lee concludes that no beneficial effects occurred. On the other hand, definite and immediate deleterious effects were observed in 1, and death was accelerated in both patients as a result of the acacia. He, therefore, believes that acacia is not an absolutely harmless agent when used in shock, hemorrhage and allied conditions.

Acetylsalicylic Acid (Aspirin). Some years ago Fetterolf called attention to the value of powdered *aspirin in the treatment of tonsillitis*. He found that, applied locally and thoroughly rubbed in, the attack was usually aborted. Heller² reports excellent results from this use of the drug after *tonsillectomy* and in *acute pharyngitis*. His report is based on nearly 1000 cases convalescent from tonsillectomy. His procedure is as follows: To patients convalescent from tonsillectomy he administers 1 to 3 gr. of powdered aspirin on the tongue, on the evening of the first day, or about eight to ten hours after the operation. They are then given the same dose ten or fifteen minutes before each meal for three or four days. Relief is almost universal. Heller stated that in the past eighteen months he can recall but 2 patients who did not voluntarily state that they were relieved. Most patients are able to swallow comfortably immediately the powder has passed the oropharynx.

In patients with an idiosyncrasy to the drug, or in whom ingestion of the drug is contraindicated, a weak solution (3 dg. to 30 cc of water) is given as a gargle, and with practically the same effect as when the drug is swallowed. This fact proves conclusively, he thinks, that it is not the systemic effect that does good.

In acute pharyngitis and simple acute tonsillitis a powder of 1 to 3 gr. of the drug is prescribed every three or four hours to be taken on the tongue without water. The results are identical with those observed in postoperative tonsillectomies.

Leech³ has studied the *change in acetylsalicylic acid in sodium citrate solution*. He states that while it has been claimed that acetylsalicylic acid may be dispensed in a solution of sodium citrate without decomposition of the acid, his studies show this to be incorrect. He found that after four days the acetylsalicylic acid is broken down to the extent of 50 per cent; after nine days to 75 per cent; and that in seventeen days it is almost complete hydrolyzed.

¹ Journal of the American Medical Association, August 26, 1922.

² Therapeutic Gazette, December, 1921.

³ Journal of the American Medical Association, January 28, 1922.

Adrenalin. The use of adrenalin subcutaneously will cut short an attack of *asthma* more rapidly than any other method, according to Hurst.¹ He states that the most efficient dose is one much smaller than is generally given. In many cases 1 minim of 1 to 1000 adrenalin chloride solution is enough; more than 2 minims are rarely required. To obtain results, however, the injection should be given at the beginning of the attack, and not half an hour or an hour later when the attack is fully developed. The relief is so immediate that Hurst states the patient will often fall asleep within a few minutes. These small doses give rise to no unpleasantness, such as frequently follow the injection of larger doses, and they can be continued for long periods.

De Valle² reports a case of *polyneuritis* which was cured with adrenalin. Daily injections of 1 mg. brought about improvement in a week and in five more weeks the cure was practically complete.

The effect of *adrenalin on the blood-pressure* is well known. Phean and Parkinson³ state that adrenalin also influences the heart, both through the sympathetic and through the vagi. In reporting a case presenting the Stokes-Adams syndrome they quote a number of observations on the effect of adrenalin on *heart-block*. They state that the clinical evidence shows that it is possible for partial block to be reduced, and for even complete heart-block to be abolished, by subcutaneous injections of adrenalin; though often it fails to modify the conduction, as one might expect from the nature of the pathologic lesion usually present in such cases. An increase in ventricular rate, however, is usually obtainable despite the block. This alone, they believe, is a sufficient ground for an extended trial of adrenalin in Stokes-Adams attacks, where the immediate cause of the loss of consciousness is usually extreme ventricular slowing and standstill.

Alcohol. The restrictions placed on the use of alcohol as a drug by the Prohibition Law continues to be a subject of discussion. The consensus of opinion seems to be that there is need of a distinction. It matters little whether the physician himself be an advocate or an opponent of the law, nearly all are agreed that they should be allowed to employ alcohol as they would any other drug and without annoying restrictions.

An editorial article,⁴ in discussing the subject, quotes a number of physicians practising different specialties to the effect that they feel alcohol has a distinct place and should not be restricted in its use as a pharmacologic agent. The editorial in question closes with the statement that "the renewed discussion of this important problem is separated as far as possible from the use of alcohol as a beverage and from its employment in social life. It deals solely with the question of whether alcohol, properly used, is one of the agents which physicians should be trained to employ skilfully in the treatment of disease. We think the answer is emphatically in the affirmative."

¹ New York Medical Journal, March 15, 1922.

² Siglo Medico, February 4, 1922; Abstract, Journal of the American Medical Association.

³ Lancet, May 13, 1922.

⁴ Therapeutic Gazette, January, 1922.

Wallace,¹ in calling attention to the restriction placed on physicians in the prescribing of alcohol, states that there are signs at present of a growing desire on the part of some individuals and some groups to restrict, by legislative proceedings, the drugs a physician may prescribe in his practice. Without entering into a discussion of the merits of prohibition, or the necessity of medical restriction in enforcing it, Wallace thinks that the medical profession should vigorously oppose such restriction. A majority opinion as to the value of any particular drug does not necessarily carry any more weight than a minority one. A physician in charge of a case automatically assumes full responsibility for it, and he should in no way be hampered in his management, provided he acts in good faith and to the best of his ability and judgment. There should be laws in force which inflict a sufficient penalty on those who, through ignorance or cupidity, fail to safeguard the welfare of their patients. Wallace believes that the principle of restricting the legitimate use of drugs is a bad one, that it will react badly on the profession, and that it ought to be actively combated.

Wallace, while admitting that opinion varies as to the various conditions in which alcohol is of value, is himself convinced that it is of the greatest service in the treatment of typhoid fever and in the management of circulatory disease.

As in the case of other remedies, the exact workings of which are unknown to us, alcohol does apparently exert a favorable influence. As a matter of practical importance, it is not necessary to prove this by scientific animal experiments. In the long run, clinical experience is the best guide, and must to some degree be individual. Thus, one man is a firm believer of a certain thing, another is skeptical. We have just quoted an article by Wallace on the use of alcohol in the treatment of typhoid fever—his belief being that alcohol is a food and, in addition, stimulates the appetite. Haneborg² has recently issued a long report of the result of his work carried out in the Physiological Institute of the University of Christiania. He concludes that the belief that alcohol is a stomachic is not borne out by his investigations.

Since prohibition went into effect, the question of WOOD-ALCOHOL POISONING has become most important. It is highly desirable that medical men should be familiar with its manifestations. And it is even more desirable that the laity be more thoroughly apprised of the danger. Ziegler³ epitomizes the essential features as follows:

1. Wood alcohol is the most deadly poison used in daily commerce.
2. One teaspoonful has been known to cause blindness and 1 ounce to cause death.
3. The port of entry may be through the mouth, nose or skin.
4. Wood alcohol should be identified by Robinson's test.
5. It is a protoplasmic poison possessing a selective affinity for the delicate nerve tissues of the eye.

¹ Medical Record, January 14, 1922.

² Acta Medica Scandinavica, November 7, 1921.

³ Journal of the American Medical Association, October 8, 1921.

6. Its biochemistry is modified by oxidation, first to formaldehyde and then to formic acid, both of which are corrosive poisons.

7. Formic acid is the end-product excreted by the kidneys.

8. If formic acid is present in the urine it will promptly reduce Fehling's solution, thus suggesting to the inexperienced a false diagnosis of diabetes.

9. Van Slyke's test will reveal acidosis in the early stages and alkalosis later.

10. Sudden blindness, with vomiting and abdominal pain, should always arouse suspicion of methyl-alcohol poisoning, especially if diplopia or ptosis is associated.

11. Papillitis, sector-like atrophy and sudden sclerosis of the nerve-head are equally typical fundus lesions.

12. Symptoms of pituitary injury are most suggestive in pointing to this as the primary and fundamental lesion.

13. Contracted fields and central or paracentral scotomas are usually present.

14. Treatment should include early neutralization by alkalis, and elimination by lavage, emetics, diaphoretics and rapid oxidation, together with stimulation of the optic nerve by negative galvanism applied directly to the eye. Thyroid extract and pituitary extract may be indicated.

15. The manufacture and sale of wood alcohol should be prohibited or regulated by law.

16. If sales are permitted, safeguards and warnings should be required, and the public instructed as to the great danger to vision and life.

17. A special revenue tax with registered "poison sales" would regulate and record its distribution and, in cases of poisoning, reveal the source.

18. This tax should equalize the cost of denatured alcohol and methyl alcohol and thus remove the temptation to adulteration because of cheapness.

19. All wines, whiskies, toilet articles and "patent medicines" imported from foreign countries should be tested for wood alcohol before passing through the customs inspection.

20. The name "methanol" specifically designates this product and yet avoids the tempting suggestiveness of the word "alcohol."

Rostedt¹ states that since the complete prohibition of alcohol in Finland serious eye conditions have totaled 60. In 50 per cent of the 60 cases blindness followed, while amblyopia was pronounced in all. The usual disturbances developed about the third day in the majority, and then continued a progressive course for from two to four weeks, after which there was usually slight improvement, but it was only transient as a rule.

An *unusual complication following wood alcohol poisoning* is reported by Barbash.² In this case occlusion of the brachial artery was noted

¹ Finska Läkaresällskapets Handlingar, March-April, 1921; Abstract, Journal of the American Medical Association.

² Journal of the American Medical Association, February 11, 1922.

on the ninth day after the poisoning, and six days later an attempt was made to remove the thrombus. It was found that the entire arterial tree of the forearm and hand was filled with clot. The hand became gangrenous.

Isaacs¹ reports on the *alkali treatment of acute methyl-alcohol poisoning*. If the patient is not comatose and is received within twelve hours after taking the wood alcohol, it is well to pass a stomach tube and wash out the contents with a 1 or 2 per cent solution of sodium bicarbonate in warm water, as experience has shown that some of the alcohol is excreted into the stomach. Three or four ounces of a 50 per cent solution of magnesium sulphate are then poured in through the tube and left in the stomach. Sometimes an hour or more after washing out the stomach the patient will vomit a considerable amount of food débris, having a marked odor of methyl alcohol. The patient should be kept warm if his temperature is low, and is given 3 gm. of sodium bicarbonate, with about 250 cc of water every two hours, for six doses, being awakened for his medication if asleep. A whiff or two of aromatic spirit of ammonia will serve to awaken the patient sufficient to make him swallow. The dose of bicarbonate may be doubled without apparent ill-effects. Following the initial six doses the patient is given 3 gm. of sodium bicarbonate in a glass of water, three times daily one hour before meals, until the symptoms have disappeared. A safe guide to the dosage is to keep the fresh urine alkaline to methyl red. Fluids are forced and the diet should be a liquid one until the acute symptoms have ceased.

If the patient is comatose, or if the cyanosis is marked, with depression of respiration, it is well to wash out the stomach first. Under these circumstances, or if medication by mouth is not retained, 1000 cc of Fischer's solution (sodium bicarbonate, 0.37 per cent; sodium chloride, 1.4 per cent at 99° F.) is given slowly intravenously. Isaacs also gives Fischer's solution in cases in which there is any doubt. No ill-effects have been noted from the treatment. If there is time and, at the same time, there is evidence of venous congestion and embarrassment of the right heart, it is advisable to perform a venesection to the amount of 100 to 300 cc before giving the intravenous injection. The injection may be given in full or half given later. A second injection on succeeding days is, as a rule, not necessary.

Spinal puncture may be performed if there is much restlessness or signs of cerebral compression. After Fischer's solution there appears to be a dehydration of the nervous tissue, with an increase of the spinal fluid. The breathing usually improves rapidly, the mental state clears, and in from six to twelve hours the cyanosis has virtually disappeared. The eye signs also improve rapidly, the blurring of vision disappearing in from twelve to twenty-four hours, although in some cases it may take slightly longer. Abdominal tenderness likewise soon disappears.

The patient should be kept in bed until the cyanosis has disappeared and the mental confusion has cleared up. The average stay in the

¹ Ohio State Medical Journal, July, 1921.

hospital was five days, with treatment for two or three days. Patients should be ordered to return at intervals to note whether there has been any change.

Allonal. Allonal is composed of allyl-iso-propyl-barbituric acid and amidopyrin. Its dose is usually 2 to 3 gr. in tablet form; as much as four tablets have been given. Burns¹ recommends this new drug and states that it is administered orally in the form of $\frac{2}{3}$ -grain tablets. His experience shows that one tablet acts well as a sedative, two tablets as a hypnotic and that two to four should be used when an analgesic effect is desired; this dose may be repeated in one to two hours where required. The action seems to be well sustained and free from any unpleasant after-effects.

Burns thinks it is safe to conclude that allonal is a remedy of real value for controlling *insomnia* and *pain*, and that it will enable us to get along with less of the narcotic pain-allaying remedies. It gave better results than morphine in many cases, and in others better than morphine and hyoscyine combined.

Ammonium Chloride. The use of this drug in the symptomatic treatment of *tetany* in children is recommended by Freudenberg and György.² It averts the acute danger and time is gained in which to bring about a permanent change in the condition by means of cod-liver oil and quartz lamp irradiation. The drug is given internally in doses from 3 to 7 gm. per day. In some instances the administration was kept up for ten days. The authors state that ammonium chloride is preferable to calcium chloride as it is more pleasant to take.

Antimony. This drug has established itself as the method of choice in the treatment of *bilharziasis*. Pavy³ reports the case in which he employed tartar emetic intravenously. The solution used consisted of 0.06 gm. of tartar emetic dissolved in 5 cc of physiologic salt solution. This was injected slowly into a vein well below the elbow-joint. The initial dose in all cases was 2.5 cc of the solution (0.5 gr. of tartar emetic). Patients who showed a good tolerance for the drug were worked up to 10 cc 2 gr.) in from four to six injections and kept on this dose with occasional remissions to a smaller dose. In some cases the maximum dose had to be approached more gradually. Doses of 0.18 gm. were given in 2 cases, but as the majority of the patients had moderately severe attacks of coughing with nausea and occasional vomiting after giving 0.12 gm. it was not thought advisable to push the dose further. The average amount given was 1.8 gm. (27 gr.). This usually meant that by the end of the course no ova were found in the urine for four weeks. The injections were given daily at first, later on—three days a week. No local effects followed the injections unless some of the fluid escaped. The same vein can be used repeatedly. One of the most interesting and constant features of the treatment was the rise in the percentage of eosinophile cells which occurred.

The patients were not confined to bed nor dieted. Neither did they receive any other form of treatment before, during or after the injection.

¹ New York Medical Journal, April 19, 1922.

² Medizinisch-klinische Wochenschrift, February 25, 1922.

³ Medical Journal of Australia, July 30, 1921.

Apocynum Cannabinum. Apocynum cannabinum, or Canadian hemp, is a drug which has been employed for a century in the treatment of heart disease. Some observers believe it is especially valuable in dropsical conditions associated with heart disease. Marvin and White,¹ in a clinical study of this drug conclude that the fluidextract has, in some degree, a digitalis-like action in cases of heart disease with *auricular fibrillation*. They report 1 case of *auricular flutter*, in which the administration of apocynum changed the condition to auricular fibrillation. The drug was withdrawn and two days later the rhythm was normal. In their opinion the usefulness of the drug in the treatment of heart disease is markedly limited because of the discomfort, nausea and vomiting, which invariably follow its administration in doses sufficiently large to affect the heart.

Marvin and White also studied the effects of *convallaria majalis*, or lily of the valley. They conclude that neither apocynum nor convallaria can be used as substitutes for digitalis. In their experience digitalis has been characterized by quicker action, more pronounced effects, less discomfort and more prolonged improvement than are seen following either of these drugs. They, therefore, state that as a result of their observations, neither of these drugs has a place in the rational treatment of heart failure.

Bacillus Acidophilus. Rettger and Chaplin² have published a paper on the therapeutic uses of this organism. The following groups were treated: (1) Chronic constipation with the symptoms of so-called autointoxication and other accompanying pathologic conditions, some of them acute, 20 cases; (2) chronic diarrhea following an attack of bacillary dysentery, 2 cases; (3) colitis, at times bloody, and more or less mucous, 3 cases; (4) sprue, 2 cases; (5) dermatitis (eczema), 3 cases.

In treating the constipation cases it was the aim to obtain a pronounced transformation of the bacterial flora of the intestines in the shortest period of time. As lactose has a marked laxative effect when taken internally in sufficient amount, persons having a history of obstinate chronic constipation at first usually receive 1 quart of acidophilus milk plus 100 gm. of lactose daily. The lactose was added to the acidophilus milk in the flask and the contents thoroughly shaken. The patients were instructed to take the daily supply in three equal portions, one in the forenoon, another in the afternoon, and the third immediately before going to bed, and in every instance at least two hours before and after meals. There were no regulations as to diet, except to warn the patients to abstain from food, which, by experience or training, they knew to be injurious.

If, in the course of three or four days, the constipation was not relieved except by an enema, which was advised when the condition of the subject made it absolutely necessary, the daily amount of lactose was increased by 25 to 50 gm. If, on the other hand, peristalsis became too active and diarrhea resulted from taking the full amount (1 liter of acidophilus milk and 100 gm. of lactose), the quantity of lactose

¹ Journal of the American Medical Association, December 21, 1921.

² Archives of Internal Medicine, March, 1922.

was reduced by 25 to 50 gm. In a few instances the volume of milk was reduced to 500 cc, with or without a reduction in the amount of lactose.

In the treatment of the diarrheal cases (including those of colitis and sprue) 100 cc of acidophilus milk without any added milk sugar were given. Persons who could not take other food in any form retained acidophilus milk and complained of no ill-effects.

In the 3 cases of *eczema* the treatment was discontinued in 2 of them before any definite results were obtained. The third patient responded completely and for five months has been free from the trouble which had been a source of constant annoyance for twelve years.

Chaplin and Wiseman¹ report on the use of acidophilus milk in the treatment of constipation. Living twenty-four-hour cultures were administered daily. With but few exceptions, 500 cc of the milk product reinforced with 100 gm. of lactose were ingested each day in two equal doses. At no time was any special or modified diet prescribed and no laxatives were given. In most of the cases the response was prompt, and daily evacuations took place. In some cases the influence of 500 cc of the acidophilus milk was less pronounced at the start, but quite an appreciable difference was obtained when the amount of the milk and added lactose were doubled. Within a few days after the ingestion of the acidophilus milk and added lactose, daily stools were obtained and a transformation of the flora took place, in which the usual mixed bacterial types gave way to a more simplified flora largely represented by the *Bacillus acidophilus*.

Two additional articles on the use of *Bacillus acidophilus* express divergent opinions. Bassler and Lutz² obtained negative results. They state that no immunity, local or general, of the real bacterial offenders was accomplished, and all that was accomplished was a simulation of the intestinal toxemia for the time being. The same result can be accomplished just as well by the use of several teaspoonfuls of lactose taken during the day. This simple procedure will stimulate an enhancement of growth of *Bacillus acidophilus* resident in the intestinal canal of all human beings in only a slightly longer time, and at a cost that is far less to the patient.

Kopeloff and Cheney³ subjected a series of psychotic patients suffering from chronic constipation to this treatment. They state that relief from chronic constipation and diarrhea was secured by the ingestion of *Bacillus acidophilus* milk and lactose in mentally normal and psychotic patients. Five of the psychotic patients receiving such treatment showed no improvement in their mental condition during the period of treatment; in 2 others improvement was slight, but no greater than might have been expected without the treatment.

Barbital (Veronal). Among 286 cases of *acute poisoning*, Boenheim⁴ states that barbital poisoning occurred in 5.7 per cent.

The drug had been taken with suicidal intent, and 5 died. All of

¹ Boston Medical and Surgical Journal, November 24, 1921.

² Journal of the American Medical Association, August 19, 1922.

³ Ibid.

⁴ Medizinische Klinik, October 16, 1921.

these cases had taken over 10 gm. Boenheim states that up to this amount the prognosis is not grave and, even with larger doses, recovery may occur. The main symptom is drowsiness to the deepest coma. The temperature is unstable. The main point of attack is the peripheral circulation, the drug apparently paralyzing the walls of the capillaries so that vasomotor disturbances are constant. A characteristic feature is the alternate dilating and contracting of the pupils.

There are no symptoms referable to the gastro-intestinal tract. The abdominal reflexes are absent, while the tendon reflexes are retained or exaggerated. The greatest danger in these cases is the development of pneumonia, which almost invariably proves fatal. If the patient survives two days, recovery occurs unless pneumonia occurs. There is no known antidote. Washing out the stomach promptly and the use of stimulants are the usual means employed to combat the poison.

Betanaphthol. This drug is recommended by Cains and Mhaskar¹ as a *vermicide*. They state that the drug is safe up to a dose of 60 gr. It acts powerfully on ankylostomas and necators. Up to 40 gr. it may be given in a single dose, and no after-purge is required. Beyond 40 gr. the drug may be given in two or three portions. It also is an effective ascaricide.

Bromides. The use of bromides for the control of nervous excitability is largely practiced and they are generally regarded as being harmless. Hunt² states that there are certain types of *epilepsy* in which the use of bromide aggravates both the irritability and restlessness preceding the seizure as well as the depression following. Patients suffering from arterial changes are peculiarly susceptible to bromide, and alcoholics are prone to develop bromide intoxication. In heart cases even small doses of bromide may depress and enfeeble the heart, and, if long continued, give rise to mental symptoms akin to paresis. Hunt believes that the use of bromides in mental disease may mask the symptoms just as thoroughly as does opium in surgical conditions.

Calcium. The use of the *calcium salts in the treatment of tuberculosis* is frequently advocated. Moendl³ has made a second report on the intravenous use of calcium chloride. In patients with a severe hemoptysis he gives 5 cc of a 10 per cent solution of calcium chloride every eight hours until the bleeding stops and continues it once a day for several days thereafter.

He also employs the drug routinely. He has given a total of 4000 intravenous injections to 250 patients. The injections are given every day or second day to a total of twenty and then suspended for a week or two. He claims for this method the subsidence of the subfebrile temperature in a number of rebellious cases and also that the effect on the cough, expectoration, night-sweats and shortness of breath was decidedly favorable.

If injected subcutaneously, or into a muscle, the drug causes a local

¹ Indian Journal of Medical Research, July, 1921.

² New York State Journal of Medicine, July, 1921.

³ Zeitschrift f. Tuberculose, November, 1921.

necrosis. Used intravenously, Moendl states that he has had no local disturbance for several years.

As already stated, calcium is advocated from time to time in the treatment of tuberculosis, but the generally accepted opinion is that it is of no value.

For many years there has existed a tradition that those who work with lime are immune to tuberculosis, or, if they have the disease, become cured. Tweddell¹ states that manufacturers of lime and gypsum informed him that their employees were apparently immune to tuberculosis. He claims that the fine particles of lime and gypsum are carried, by inhalation, into the lungs. The lime coming into contact with the moist tissue of the lungs forms calcium hydroxide, which acts as a caustic and antiseptic and is then absorbed. Gypsum acts in the same way.

Tweddell also cites observations and references to show that calcium added to the food not only helps prevent tuberculosis, but also favors the healing of wounds and fractures. In this connection, it might be stated that extensive studies on calcium metabolism in tuberculosis has failed to show that it exerts any favorable influence on the disease.

Camphor. An oil solution of camphor, according to Rao,² is made by first dissolving the camphor in ether and then adding the solution to sterilized olive oil. The solubility of camphor in ether is 12 to 7. The solution must be quite clear before it is added to the oil. In the treatment of *sciatica*, Rao used a solution containing 0.5 gr. of camphor to each cc. The first dose was 3 cc, and injected with the usual antiseptic precautions. The injection was made deep into the gluteus muscle of the affected side and slightly away from the nerve.

As olive oil is fairly heavy, with a large "drop," it is necessary to choose a needle with a large caliber. The injections were repeated every day until six were given, the increase being 1 cc up to 6 or 7 cc. The patient reported by Rao obtained some relief from the third injection and, although previously bed-ridden and suffering great pain, was able to walk and complained only of some numbness in the limb. The sharp, agonizing paroxysms of pain ceased. Four days after the last injection there was a recurrence of slight pain which was relieved by two injections of 6 cc each. These final injections apparently stopped the pain and the patient was able to be about and attend to her needs.

Carbon Tetrachloride. A year ago Hall³ concluded, from experiments on dogs, that carbon tetrachloride was more effective against *hookworms* than any of the drugs commonly used, even when these are used in such combinations as chloroform and chenopodium. He found it safe, giving rise to no evident symptoms or postmortem lesions, even in doses five times as large as are necessary to give dependable efficacy against hookworms. Only a pure and carefully refined carbon tetrachloride should be used. The drug is also very effective for removing ascarides, although somewhat inferior to chenopodium in this respect.

¹ Medical Record, January 28, 1922.

² Madras Medical Journal, September-October, 1921.

³ Journal of Agricultural Research, April 15, 1921.

In common with other anthelmintics, it will remove whipworms, but is of no value against tapeworms. In a later communication, Hall¹ records further experimental work on the toxicity of the drug in monkeys. It would seem from these experiments that the drug could be used safely in man. Hall states that carbon tetrachloride has the advantage of being much cheaper than thymol or chenopodium, and can be purchased almost anywhere at any time. A great advantage it possesses is that it does not depress unstriated musculature or lessen peristalsis so far as has been studied. This fact would permit of an immense saving by the omission of a purgative in carrying on hookworm campaign involving millions of people.

Leach² has made a preliminary report of 14 cases of hookworm disease, in which he employed carbon tetrachloride. In all but 1 case the only symptoms complained of were slight giddiness and a sensation of weight in the stomach. In 1 case diplopia and nausea were experienced. Little effect was produced on the heart action. Leach concludes that carbon tetrachloride given in 10-cc doses to a man produced no ill-effects as far as could be seen on microscopic examination. Twelve cubic centimeters of carbon tetrachloride removed all hookworms and ascarides, but apparently had little effect on trichurids and oxyurids.

Chaulmoogra Oil. The success that has been met with in the treatment of *leprosy* with chaulmoogra oil has naturally led investigators to the hope that tuberculosis might also be benefited, inasmuch as both diseases are due to an acid-fast organism. It would appear, from the work of Walker and Sweeney,³ that the unsaturated fatty acids of chaulmoogra oil have a specific germicidal action upon acid-fast bacteria, being one hundred times more powerful than phenol. This explains their beneficial and even curative influence in leprosy, and awakens the hope that they will prove effective in tuberculous affections.

The great difficulty with chaulmoogra oil is that it is so repugnant to the taste and so disturbing to the gastro-intestinal tract that its internal administration has been unsatisfactory, while its irritating character makes it unsuitable for subcutaneous injection. Thus far, only two of the peculiar groups of fatty acids present in chaulmoogra oil have been isolated, but chemists are at work on the subject. It may also be possible to construct these acids, which are found not only in chaulmoogra oil, but also in cod-liver oil, synthetically, and to modify and improve them with a view of increasing their therapeutic efficiency.

Some of the ethyl esters of the mixed fatty acids have been used and are free from the disadvantages of the oil itself, when given intramuscularly. Rogers has employed the so-called *gynocardates* with benefit.

In a study of the *gynocardate derivatives*, Chara⁴ has shown that

¹ Journal of the American Medical Association, November 21, 1921.

² Ibid., June 10, 1922.

³ International Journal of Surgery, 1921.

⁴ Japan Medical World, January, 1922.

sodium gynocardate, gynocardate ethylester and gynocardate idioethylester produce central paralysis. The action is most marked with sodium gynocardate and least so with the ethyl ester. On bloodvessels all three drugs have a contracting action.

A most interesting and important contribution on the use of *chaulmoogra oil in the treatment of tuberculosis* has been made by Lukens.¹ He employed the drug in *tuberculous laryngitis*. Lukens found that the remedy was best applied by means of intratracheal or intralaryngeal injection. One cubic centimeter of the oil, usually 10 or 20 per cent, in liquid petrolatum or olive oil, is drawn up in a Luer syringe armed with a metal Eustachian catheter. While the patient holds the tip of the tongue, wrapped in a paper napkin, between the index finger and the thumb of the right hand, the syringe tip is introduced, guided by the throat mirror, into the pharynx (not the larynx) above and behind the epiglottis, care being taken not to touch any portion of the mouth or throat. Two-thirds of the contents of the syringe is discharged, drop by drop into the trachea while the patient breathes quietly. The remainder is then dropped on the cords while the patient phonates. In this way, cough following injection is very slight and often entirely absent. When present it comes on a few minutes after the injection and only lasts a minute or so.

Lukens concludes that the chief value of the oil is in the relief of pain and dysphagia and that this is continuous, in contradistinction to that produced by cocaine. The treatment is not unpleasant or distressing, is without untoward reactions in the larynx, and can be used without previous cocaineization. While the improvement is not all that could be desired, it seems better than that obtained with other drugs. I have knowledge of several very distressing cases in which this use of chaulmoogra oil gave great relief and even offered a hope of curing the local lesions.

An experimental study of chaulmoogra oil in the treatment of tuberculosis has been made by Culpepper and Ableson.² Forty-eight guinea-pigs were divided into five groups: (1) 12 pigs were inoculated with human-type bacilli and left without further treatment as controls; (2) 12 pigs were similarly inoculated and divided into groups of 3 each, which were given intraperitoneal doses of the acid sodium salts of the four fractions A, B, C and D of acids of chaulmoogra oil; (3) 8 pigs were left as entirely untreated controls; (4) 12 non-tuberculous pigs received increasing amounts of A, B, C and D fractions in a toxicity test.

These results showed that 1 per cent solutions of the acid sodium salts of the four fractions are least irritating and are readily absorbed from the peritoneum. No pathologic findings could be attributed to the drug. A bactericidal action on tubercle bacilli in 1 to 10,000 dilution was found. Of the 12 control pigs all died except 1. Of the 12 treated pigs, only 1 died. The others were killed for comparison, 1 whenever a control animal died. A marked difference in pathologic

¹ Journal of the American Medical Association, January 28, 1922.

² Journal of Laboratory and Clinical Medicine, May, 1921.

findings was observed, the advantage being in favor of the treated pigs. The treated animals showed an average gain of weight of 49 gr. over the ones not treated.

Leonard Rogers,¹ in an experimental study of tuberculosis treated with derivatives of chaulmoogra oil, especially sodium morrhuate, sodium gynocardate and hydrocarbic acid, obtained negative results. He points out, however, that these animal infections are equivalent to acute general tuberculosis in man, so that the failure in such cases does not prove the drugs to be useless in the more chronic forms of tuberculosis, which form the great majority of human cases. Rogers concludes that these drugs are worthy of further trial in the more chronic forms of the disease, and especially in lupus and surgical tuberculosis, where any changes will be visible and easily observed.

Harper² reports on 200 patients who are undergoing treatment for *leprosy* by intravenous injections of chaulmoogra oil. Since the treatment was started over 26,000 injections have been given. No serious effects have occurred, except for two subcutaneous abscesses due to faulty technic. Both healed promptly. The dose must be adjusted for each patient, as the toleration varies considerably. The temperature chart alone is no guide to dosage. Reactions may consist of tachycardia, fever and a blotchy, red, raised eruption, sometimes accompanied by swelling of the nodules and infiltrations, which are then completely, or partially, absorbed. These reactions are seldom very disturbing, and in most cases improvement takes place without the reaction being severe enough to be noticed.

Thirty-eight patients have been under treatment for periods of up to eleven months. Twenty-eight have improved, 1 died of influenza, 3 have become worse and in 6 there has been no change. Previous reports on the treatment of leprosy have shown that the oil or its derivatives must be administered for periods of a year or more before a cure can be effected.

Its use in tuberculosis must also be prolonged if the analogy between the two diseases in this respect is correct.

A note in the *Army Medical Bulletin* for January 18, 1922, sounds the following warnings: "The United States Public Health Service has felt it necessary to deplore the too optimistic and extravagant claims recently appearing in the newspapers in regard to the curative effects of chaulmoogra-oil derivatives on leprosy. While the use of the oil and its derivatives has resulted in a considerable number of apparent cures, it is as yet too soon to tell whether these will be permanent.

The ethyl esters of chaulmoogra oil, the use of which has largely supplanted that of the oil itself, constitute a most valuable agent in the treatment of leprosy. In treating young persons and those in the early stages of the disease the improvement has been rapid and striking; in older persons and older cases it is less so; of the cases paroled from the leprosy stations in the Hawaiian Islands, so far about 8 per

¹ Lancet, June 4, 1921.

² Journal of Tropical Medicine and Hygiene, January 2, 1922.

cent have developed and returned for treatment. This was to be expected; and, on the whole, the results have been so favorable as to make treatment of the disease hopeful. But only time can tell."

Chinosol. The use of an ointment of chinosol in the treatment of *erysipelas* is reported by Lusk.¹ The formula for making the ointment is as follows: Cold, sterile water, 0.5 dr.; add and dissolve powdered chenosal, 10 gr.; then add sodium chloride (reagent), 4 gr. Rub up, first with lanolin, 0.5 oz., finally incorporating petrolatum, 0.5 oz. This ointment, while applicable for use in the treatment of *erysipelas* on any skin area of the body, was generally used for all parts only in children, its use in adults being generally limited to the face and ears.

Cocaine. In the course of ten weeks' time Pulay² encountered 5 cases of erythema in the region of the fifth nerve, resulting from the abuse of cocaine. In 1 case there had been also an attack of convulsions and unconsciousness, with a rapid pulse and widely dilated pupils. All of these patients confessed that they had been trying the drug. In some other cases the rash developed after the use of the drug by a dentist. In 1 of these cases there was an epileptic seizure the same evening, and the erythema developed the next morning.

In some experimental work Mayer³ injected morphine before or after cocaine in frogs. The control frogs, which were injected with cocaine, alone survived, while all of those receiving both morphine and cocaine died. Mayer believes that this shows that the morphine enhances the toxic action of the cocaine, and that the custom of injecting morphine before using cocaine is dangerous. He found, furthermore, that calcium chloride seems to inhibit the action of cocaine. A small dose of cocaine stimulates the frog heart, while a large dose arrests its action, but calcium chloride starts it to beating again. When the calcium chloride was given first the cocaine had no toxic action. Mayer also found that in frogs, while calcium salts arrest the toxic action of cocaine, potassium salts exaggerate it.

Cod-liver Oil. This substance is now recognized as being practically a specific in the treatment of *rickets*. While it has been used for a long time in this condition it is only recently that its specific value has been demonstrated. The proof of this has been furnished by Park and Howland.⁴ They have studied the bone changes by means of the roentgen rays. Their results in many cases have been so consistent that they feel justified in stating definitely that cod-liver oil brings about a change in the bones, which, if the diet is not too faulty, amounts to complete cure. The change is not noticeable at once, but is readily demonstrated in nearly all cases by the end of a month. By the end of two or three months so much infiltration with salts has taken place that the extremities of the bones, except for deformities, are practically normal, and only differences in the finer architecture

¹ Annals of Surgery, February, 1922.

² Medizinische Klinik, March 26, 1922.

³ Schweizerische med. Wochenschrift, August 18, 1921.

⁴ Bulletin of Johns Hopkins Hospital, November, 1921.

of the ends of the bones indicate the previous existence of a rachitic process.

The work of Park and Howland and that of others who have reported most excellent clinical results make it reasonably certain that rickets can be cured entirely.

Corpus Luteum. In previous numbers of PROGRESSIVE MEDICINE we have quoted the favorable results obtained by J. C. Hirst in the treatment of the *vomiting of pregnancy* with corpus luteum.

King¹ does not share Hirst's enthusiasm. The mild cases, he states, do respond, but the same can be said of any line of treatment. King states that in his experience ovarian extract, horse serum, thyroid extract and epinephrin do not measure up to the expectations aroused by some articles in the literature. In his opinion the best results are obtained in the toxemia of pregnancy by the use of sedatives, colonic irrigations of sodium bicarbonate solution, forced fluids, glucose, etc., and he furthermore believes that therapeutic abortion should not be too long delayed in refractory cases. Pinard's dictum that we should abort when the pulse is persistently above 100, while, in King's opinion, unduly radical, is a good guide, especially when considered in connection with the general condition of the patient and laboratory studies of the blood and of the urine.

Creosote. Thorling² reports a case of poisoning with creosote in an infant, aged two months. The creosote had been given by mistake for a laxative. The symptoms resembled very closely those of Winckel's disease. The amount taken was not over 1 gm. at most, but the child died in two and a half days. There was little evidence of any local caustic action, the mouth clearing up readily. There was slight vomiting at first but no intestinal symptoms at any time.

The main symptoms were hemolytic jaundice, hemoglobinuria and a leukocytosis. Twelve hours after the ingestion of the drug the red cells numbered 1,800,000 and the leukocytes 25,000. Thorling suggests that the possibility of a chemical irritant should be thought of in children presenting obscure clinical pictures, instead of assuming them always to be infectious in origin. This is particularly important because of the susceptibility of young children to chemicals which have a destructive action on the blood.

Dibromine. This is a new bromide compound which possesses considerable germicidal power. It is a crystalline substance, white in color, odorless except for a faint suggestion of bromine, and does not possess an objectionable taste. Furthermore it makes a water-clear solution, which does not stain the skin or clothing.

Saint-Pierre³ has employed the drug in solution in the treatment of a series of 225 cases, including *metritis* in young women, *tubal catarrh*, *leucorrhea* and *vulvar pruritis*. In each case the patient was given daily douches of two pints of dibromine solution, 1 to 15,000. Soon

¹ Journal of the American Medical Association, February 18, 1922.

² Upsala Läkareförenings Förhandlingar, September 1, 1921; Abstract, Journal of the American Medical Association.

³ Therapeutic Gazette, June, 1922.

after these douches were applied the character of the discharge was changed to a less purulent condition and a considerable loss in odor. The treatment also had a cleansing effect and showed a marked influence upon the bacterial flora of the parts irrigated, with an absence of any trace of irritation.

A great advantage also lies in the fact that the solution is colorless and does not stain the undergarments.

Diet. The World War brought about a condition of affairs regarding the food supply that made the subject of dietetics of universal interest. The result has been that for the past four or five years the medical and lay journals have contained a large number of articles on the subject. One noteworthy effect has been that physicians have taken a more keen interest in a subject which is of the most vital importance in dealing with disease.

McCarrison,¹ who has previously contributed articles on the effect of faulty food in relation to *gastro-intestinal disorders*, made this the subject of the Mellon Lecture, held under the auspices of the University of Pittsburgh. From a review of the dietetic habits of primitive people and experimental observations on monkeys, he believes, he is justified in drawing certain broad conclusions:

1. The health of the gastro-intestinal tract is dependent on an adequate provision of vitamins. The absence of growth vitamins is capable of producing pathologic changes in the tract, which frequently assume the clinical form of colitis. This observation is of the highest importance in view of the frequency with which this malady is encountered at the present day. Deficiency of vitamin C is especially concerned in the production of congestive and hemorrhagic lesions in the tract, and evidence of these may be found in animals which have not exhibited during life any of the clinical evidences of scurvy in noteworthy degree. A state of ill-health of the gastro-intestinal tract may thus be a prescorbutic manifestation of disease due to insufficiency of this vitamin, especially when associated with an excess of starch or fat or both in the food.

2. The disorder of the gastro-intestinal tract consequent on vitamin deficiency is enhanced when the food is ill-balanced.

3. The pathologic processes resulting in this situation from deficient and ill-balanced foods are: (a) Congestion, necrotic and inflammatory changes in the mucous membrane, sometimes involving the entire tract, sometimes limited areas of it. (b) Degenerative changes in the neuro-muscular mechanism of the tract, tending to dilatation of the stomach, following of areas of small and large bowel, and probably also to intussusception. (c) Degenerative changes in the secretory elements of the tract; these changes are such as must cause grave derangement of digestive and assimilative processes. (d) Toxic absorption from the diseased bowel as evidenced by changes in the mesenteric glands. (e) Impairment of the protective resources of the gastro-intestinal mucosa against infecting agents, due to hemorrhagic infiltration, to

¹ Journal of the American Medical Association, January 7, 1922.

atrophy of the lymphoid cells, and to imperfect production of gastro-intestinal juice; this impairment not only results in infections of the mucous membrane itself, but also permits of the passage into the blood stream of microorganisms from the bowel. (f) It is to be emphasized that the pathologic changes found in the gastro-intestinal tract are more marked in some individuals than in others; and that, while all of them may occur in one and the same subject, it is usual to find considerable variation in the incidence of particular lesions in different individuals.

The vitamin C referred to by McCarrison is found principally in lime and lemon juice, orange juice, tomatoes, sprouted seeds and fresh unpasteurized milk. The last-mentioned is especially important in furnishing the growth vitamin.

McCarrison states that there are three distinct duties to be performed: (1) To instruct the masses as to what to eat and why they eat it; (2) to apply the results of our science to the production of natural foods in abundance and to their widespread and cheap distribution, rather than to the erection of institutions for the treatment of maladies due to their want; (3) and most important, ardently to pursue our investigations and the acquirement of knowledge.

An *acute form of food infection* is now recognized to be due to contamination with the bacillus of Gärtner (*Bacillus enteritidis*). Rosenau and Weiss,¹ in reporting a small epidemic, give an excellent review of the subject.

In 112 outbreaks studied in Great Britain there were some 6190 cases, with 94 deaths, a mortality of 1.5 per cent.

Most of the cases occur in summer time. As the bacilli responsible for food infection grow in the food before it is eaten, the temperature is a very important factor. The greater multiplication of these bacteria in hot weather also increases the opportunities of transmission of infection through flies and other means.

The great majority of outbreaks of food infections are due to meat foods; hence, the frequent use of the term "meat poisoning" in this connection. Of the 112 British outbreaks, in 21 the vehicle was a non-flesh food. Pork or beef accounted for 68 per cent of the British, and 61 per cent of the continental outbreaks. Instances of this form of food infection are rare in this country.

The symptoms of food infection are essentially those of an acute gastro-intestinal irritation, namely, nausea, vomiting, abdominal pain and diarrhea. The condition is distinctly different, therefore from botulism, in which there is an absence of gastro-intestinal symptoms. The onset in food poisoning is usually sudden and may be ushered in with headache and a chill. The abdominal pain is frequently the first symptom, and may be griping and severe. The diarrhea usually consists of repeated bowel actions, which, as a rule, are offensive. Later in the attack the stools become more watery and of a green color. Faintness, muscular weakness and prostration may be quite marked.

¹ Journal of the American Medical Association, December 17, 1921.

Thirst is always present and there is almost always some fever, usually 102 to 103° F. In some cases restlessness, muscular twitchings and drowsiness may occur.

The severity of the symptoms varies greatly in different outbreaks and even in the same outbreak. The symptoms vary with the dose, that is, with the number of bacteria ingested with food. The severity doubtless depends on the virulence of the particular strain of bacteria concerned, the length of time it had to grow upon the food before consumption and the temperature of growth.

The incubation period ranges from six to twelve hours, but may be delayed for as long as seventy-two hours.

The diagnosis depends on the history of exposure to the suspected food: Symptoms suggestive of food poisoning; isolation of the infecting organism from the suspected food, and also from the blood, urine, feces or viscera of the patient.

The outbreak reported by Rosenau and Weiss occurred in a group of medical students. There were 25 and of this number 18, who had partaken of the spread, were made ill. All of these who had eaten bread pudding had symptoms, whereas those who did not partake of this food remained free from symptoms. The evidence was, therefore, strongly in favor of the pudding being the offender. Analysis of the pudding revealed the presence of a mildly virulent *Bacillus enteritidis*.

The symptoms displayed by the students were quite characteristic, namely, diarrhea, somewhat offensive stools, nausea and vomiting. The temperature rose in most of the cases to 102° or 103° F., but rapidly fell to normal in from twenty-four to forty-eight hours. One of the patients complained of some numbness in his fingers and contraction of the muscles of the hand and 1 had contractions of the muscles of the face.

BOTULISM. This form of food poisoning continues to be reported. The classic source of botulism is sausage; hence, the name "botulism," from the term "botulus," a sausage. It is now known, however, that botulism occurs from the eating of other foods which have become contaminated by the *Bacillus botulinus*. The disease first attracted attention in this country from outbreaks following the eating of ripe olives. Since then other food products, usually canned vegetables, have been the source of the trouble. The reason for this has been pointed out in an editorial article.¹ An analysis of the reported outbreaks has shown that certain articles of food are implicated more frequently than others. First come the foods preserved by heat. Since the air is expelled in the heating process, and since the containers of these foods must be hermetically sealed, it is easy to see that the anaërobic conditions so produced provide particularly favorable opportunities for the growth of any *Bacillus botulinus* spores that have survived the heating process. As with other bacteria, growth of the botulinus spores is hindered by a high concentration of sugar or brine, or by a marked acid reaction. Botulism from the eating of jam or

¹ Journal of the American Medical Association, July 1, 1922.

candied fruits or from brine-pickled green olives is unknown; indeed, the disease has been very rarely attributed to the use of any sort of preserved food.

Inasmuch as botulism is so frequently traced to the eating of canned foods imperfectly sterilized, it is not surprising that a relatively high proportion of the outbreaks should have been traced to foods canned in the household, where facilities for maintaining cooking temperature considerably above the boiling-point are not always readily available. Even commercially canned vegetables are not free from the danger, as several outbreaks have followed the use of such products. Spinach seems to be especially hard to secure the adequate amount of heat penetration to effectively kill the botulinus spores.

Although the actual number of deaths in a year from botulism is not very large, probably considerably less than 100 in the whole United States, its high case mortality (more than 60 per cent) and our present therapeutic helplessness combine to urge intensive study of each outbreak.

Vedder¹ reports a small outbreak following the eating of sausage. Of the 6 men infected, all had eaten the sausage raw, while those who ate it cooked escaped. The sausage had been purchased on Saturday and kept in an ice-box until the following Monday. It was known that the allowance of ice was insufficient to preserve meat satisfactorily. All of the infected men presented the characteristic symptoms, namely, difficult swallowing, blurred vision, diplopia, dizziness and weakness of the legs.

Colver,² in commenting on 5 cases of botulism, directs attention to the fact that it is essentially a toxic encephalitis affecting the pons and medulla, and with a rapid course. Epidemic encephalitis, with which it may be confused, affects, as a rule, the cortex, the meninges or the basal ganglia of the upper cranial nerves and pursues a more deliberate course than botulism.

Beal³ reports a particularly severe outbreak following the eating of a meal of canned salmon and canned spinach. Within from twelve to twenty-four hours 9 persons, all of whom had partaken of this meal, and all of whom had certainly partaken of the spinach developed typical symptoms of botulinus poisoning. All persons who ate some of the spinach developed symptoms, while no one in the hospital became ill who had not eaten the spinach, and there were 4 or 5, though they did eat the salmon.

Wells⁴ reports a single case in which canned spinach was the offender.

The relative frequency with which canned spinach has been implicated led the Bureau of Chemistry of the Bureau of Animal Industry, United States Department of Agriculture, to study the subject. Kosner, Edmondson and Giltner⁵ examined bacteriologically a total of

¹ Medico-Military Review, September 15, 1921.

² Michigan State Medical Society Journal, October, 1921.

³ Journal of the American Medical Association, July 1, 1922.

⁴ Michigan State Medical Society Journal, October, 1921.

⁵ Journal of the American Medical Association, October 15, 1921.

174 cans of spinach. These were selected from various shipments believed to be connected with botulism outbreaks and also from a number of other lots which were suspected of being imperfectly processed. Of the entire number, 92 were normal, and 82 were either "swollen" or "springy." The term "flat," "swollen" or "springy" are used to designate the condition of the ends of the can. Normally, a can should be "flat" (slightly concave), owing to a decreased pressure within the can. The "springy" or "swelled" condition is caused by an increase in pressure resulting from gas production within the can. A "springy" can may result also from improper exhausting.

The contents of 6 of the 82 abnormal containers were found to be toxic when fed to guinea-pigs. One of these 6 cans presented a peculiar condition in that, while animals were regularly killed by feeding small amounts of the spinach juice, cultures of *Bacillus botulinus* could not be obtained.

They found that *Bacillus botulinus*, Type A, is able to multiply and to produce its characteristic toxin in canned spinach, although the development of the organism in this food product was found to be somewhat irregular.

The important practical information is that of the 6 toxic cans all were "hard swells," and when opened the odor was distinctly offensive. The destruction of foodstuffs deemed to be abnormal, either by appearance of the containers or by the odor, should prevent the greater number of the outbreaks of botulism. From the public health aspect of the problem, the last point is of special importance.

The thermal death point of *Bacillus botulinus* spores has been studied by Weiss.¹ The juices of thirty-six varieties of canned food on the American market furnished the material. He found that the thermal death-point varies with the hydrogen-ion concentration of the particular food and also on the consistency of the food, the more fluid products requiring a shorter period of exposure at a given temperature than the less fluid ones. The thermal death-point is also influenced by the presence and concentration of syrup. The heavier the syrup, the longer the period of exposure required at any one temperature.

Treatment. At present this is unsatisfactory. As pointed out in an editorial article prompt recognition is important, both in order that the offending food may be recognized and, when necessary, official measures of control instituted, and, also in order that botulism antitoxin may be given a fair trial. Animal experimentation is somewhat encouraging, but so far the antitoxin has not shown much benefit in human cases. It is possible that, as in the original use of diphtheria antitoxin, the serum is not administered early enough.

Most patients die within four or five days. So far as at present known, the only hope lies in early recognition and the prompt administration of the antitoxin.

Beal² used the antitoxin in several of his cases with varying results. Wells³ used antitoxin in a single case. He states that definite improve-

¹ Journal of Infectious Diseases, October, 1921.

² Loc. cit.

³ Loc. cit.

ment in swallowing, in speech, and in general appearance followed the administration of serum from the third day and at times temporary relief of the sense of constriction in the throat and of occasional difficulty in breathing was mentioned by the patient about an hour after the serum injection.

THE CALORIC INTAKE. Prior to the food shortage caused by the World War the measurement of food by computing the calories was confined to a relatively few. The laity knew nothing of the subject and the great majority of practising physicians were equally ignorant. The subject became simplified and practically applicable by interpreting the calories in terms of common household measures. This plan has been effectively used by Joslin in his *Manual for Diabetics* and by Emerson in his *Nutrition Classes*. Although the method is to be regarded as a rough measurement it is certainly preferable to the entire ignorance which formerly prevailed. It at least enables one to form some idea of how much the patient is getting.

An excellent editorial article¹ points out that, as the result of food restrictions during the war, the caloric intake in the warring countries fell from 3000 per capita to 1800, to 1000, and in some instances to 800. As a result, there were some who questioned whether the figure 3000 was not too high and that man would be better off on much less food. This opinion was formed by the report that diabetes and certain gastrointestinal disorders diminished as a result of a restricted food intake. Later, it became evident that an inevitable result was undernutrition and the attendant ills.

The article quoted points out that when freedom of choice exists the intake of the "average" man, no matter where he lives, approximates 2700 calories. The customary food habits of the world represent an optimum which we must not juggle. The experiences of the war taught clearly that departure from these standards leads to undernutrition and its consequences, from which neither enhanced digestion nor mastication nor any panacea can furnish protection.

NUTRITION CLASSES. One of the good results of the increased interest in food values has been to focus attention on the nutritive needs—the caloric requirements—of children. It is now clearly known that during adolescence the needs of children of both sexes may exceed by nearly 1000 calories a day for each person the requirements of the adult man or woman of moderate activity.

The problem of the undernourished child has been dealt with in previous issues of *PROGRESSIVE MEDICINE*. It may not be amiss, however, to recall the various factors which lead to these undernourished states. These have been summarized by Easton² in a report of the Child Welfare Society of Washington, D. C.: (1) Late hours. Many parents considered 9 o'clock as an early hour for bed, and not a few children went to bed at 11 and 11.30 P.M. (2) Overfatigue. This resulted from failure to observe periods of rest after overindulgence in play, and in some cases from lack of proper amount of sleep. (3)

¹ Journal of the American Medical Association, December 17, 1921.

² Ibid., February 4, 1922.

Insufficient outdoor air by day and night. Some children insisted upon playing indoors. In the case of families living in apartment houses, the time for the outing of children was limited because of the household demands made on the mother. Moreover, the shortage of adequate housing facilities necessitated the use of bedrooms by too large a number of persons. In a few instances, the windows were not kept open enough during the night. (4) Two meals a day. These were the reward of "Late to bed and late to rise." (5) Irregular meals. The children eating at irregular hours usually found the family table deserted and grew accustomed not to eat at the table and preferred eating from the hand. (6) Improper diet. Coffee, tea, sausage and sauerkraut were samples of the many unsuitable foods which were given to children under six years of age. Candy between meals seemed also to be the rule. (7) Diet of low caloric value. This was determined by calculating the calories of the child's dietary, which was submitted by the mother.

OBESITY AND DIABETES. It will be recalled that about a year ago Joslin called attention to the close relation that existed between obesity and diabetes, the former only too often carrying with it the penalty of becoming diabetic. It is interesting that at the time Joslin's article appeared the Phipps Institute had just completed a survey of the policemen and firemen of Philadelphia. In this study there were found 25 cases of unsuspected diabetes, and in every case the affected individual was obese and sedentary in habit. The lesson to be learned from these observations is that people who incline to obesity should regulate their diet and indulge in sufficient exercise to keep the weight within safe limits.

As many of these so-called "prediabetics" do not show sugar in the urine under normal conditions, studies are now being made to determine methods to anticipate the diabetes. Beeler and Fitz¹ report on the glucose tolerance of a group of stout persons exhibiting sugar-free urines on routine examination. The majority of the patients observed showed no fasting hyperglycemia and had a nearly normal blood-sugar curve after the ingestion of 100 gm. of glucose. A few of the obese, however, showed a curve of glycemia resembling that of mild diabetes.

Reference has been made to the effect of famine in Europe on the incidence of diabetes and obesity. While these seem to have diminished, tuberculosis has certainly been increased as the result of under-nutrition. Another phase of the diet has been the allegation that the change in diet has increased the incidence to *gastric cancer*. This, according to Janowitz,² is not true. A careful study made by him shows no evident alteration in either the number or the location of cancers of the digestive tract as observed in Berlin during the war, when compared with a similar group of population before the war.

¹ Archives of Internal Medicine, December, 1921.

² Zeitschrift f. Krebsforsch., 1921, 18, 34.

PELLAGRA. Goldberger,¹ who has long championed the dietetic hypothesis of pellagra, has recently reviewed the subject. He concludes that diet controls the course and development of the disease, and that the relationship then disclosed probably depends primarily on a specific quality of the amino-acid make-up of the protein supply.

RICKETS. A tremendous amount of attention has been devoted to this disease within the past few years under the heading "heliotherapy." Reference has been made to the effect of sunlight as a preventative and curative agent.

McCollum, Simmonds, Shipley and Park² believe that rickets is dependent on a diet low in phosphorus and the fat-soluble A vitamin. Sweet³ expresses the belief that the hypothesis that rickets is due to a deficiency of fat-soluble A vitamin in the diet has not been proved. He thinks it is primarily due to a diet deficient in fresh animal food, probably suitable protein, or to a disturbed digestive condition which prevents the assimilation of the same. Confinement of young animals with its attendant evils of lack of sunshine, exercise and cleanliness are important factors in increasing the severity of the disease.

VITAMINS. As usually happens with the introduction of a new therapeutic remedy, there follows a period in which the most extravagant claims are made. At present vitamins occupy a prominent place in the literature, and, as a result of this, they are being heraled as a panacea for all sorts of ailments. In an editorial comment⁴ it is stated that: "The medical profession is unquestionably facing a problem in connection with the current widespread public propaganda for the therapeutic use of yeasts and so-called vitamin preparations. Every person who reads—whether it be the monthly or weekly magazines, the daily newspapers, or even the billboards—is likely to find gratuitous reminders that he is confronted with menaces to health which not only ought to be averted but can readily be remedied, when present, by the simple expedient of a patent medicine or proprietary product.

"No one will deny the great contribution which the discovery of the vitamins has made to physiology and medical progress." It is to be borne in mind, however, that the source of these substances is to be found in the garden rather than on the druggists' shelves."

Furthermore, it is well, at present, to keep in mind that relatively little is known about the vitamins. The British Medical Research Council in commenting upon this subject says: "The present situation is a curious one, upon which posterity will probably look back with great interest. We still have almost no knowledge of the nature of these elusive food substances or of their mode of action, but we have gained empirical knowledge already of the greatest practical value for the prevention of scurvy and of other grave diseases and for the promotion of health and beauty in the population."

Common sense is much needed at present when vitamins are under

¹ Journal of the American Medical Association, June 3, 1922.

² Journal of Biological Chemistry, August, 1921.

³ British Medical Journal, December 24, 1921.

⁴ Journal of the American Medical Association, April 15, 1922.

discussion. This attitude is well taken in an editorial comment:¹ "A normal adult," it says, "living on an ordinary diet containing a reasonable proportion of fresh vegetables is, therefore, certain of obtaining a plentiful supply of vitamins." Holt,² in an article on the practical application of the results of vitamin studies voices the same opinion in regard to the dietary of children. He states that if the daily diet contains in reasonable amounts unskimmed milk, cereals, potato, green vegetables and fruit, one need not fear a vitamin deficiency. While these articles are especially rich in vitamins, nearly all of our common foods contain them. "Of all the mass of evidence which has accumulated relative to these substances, this fact is the point of greatest importance. It is, however, very unfortunately, the one point which those commercially inclined are unwilling to recognize."

The commercial aspect of the problem has been studied by McCollum and Simmonds.³ They state that no evidence whatsoever has been brought forward to show that an excessive amount of one or another of the vitamins is of value in the nutrition of either the sick or the well, but there is today a great wave of enthusiasm on the part of the public for information concerning them. There prevails in the minds of most people, they continue, a child-like confidence that these substances must have a medicinal value. As a result, all sorts of "vitamin preparations" are being placed on the market, and enthusiastic claims made for their curative properties. It was for this reason that McCollum and Simmonds made a study of a number of these commercial preparations. They conclude that the claims are extravagant and misleading, and that the drug store is not the place to secure vitamins.

Emmett⁴ has contributed an excellent review of vitamins. He points out that it was some thirty-five or forty years ago that the etiology of beriberi—an endemic nerve disease which was very prevalent in the Orient—was found by the Japanese to be associated with a faulty diet. Eijkman was able to produce this disease experimentally in fowl by feeding them on milled rice. Later, Fraser and Stanton extracted a substance from the rice millings which prevented and cured the disease—polyneuritis—in pigeons. In 1911, Funk succeeded in concentrating this substance still further. Since this material seemed so important to life, Funk called it vitamin.

This vitamin related to and was specific for beriberi. Therefore, it was designated as the antiberiberi or antineuritic vitamin. Later, as other vitamins were discovered, it became known as the water-soluble B type.

In 1913, McCollum and Osborne and Mendel, working independently, showed that there was another factor that related to growth and body conditions. This was found to be present and soluble in certain fats and oils. This is now known as the fat-soluble A type. Besides these two types there is a third, which Drummond has designated as

¹ British Medical Journal, February 11, 1922.

² Journal of the American Medical Association, July 8, 1922.

³ Ibid., June 24, 1922.

⁴ Therapeutic Gazette, November, December, 1921; January, 1922.

water-soluble C. This vitamin appears to be specific for scurvy. Table I, taken from Emmett's article, shows at a glance the distribution of the vitamins.

TABLE I.

Vitamins appreciably present in		Vitamins practically absent in	
Fat-soluble Type.			
Cod-liver oil	++++	Yeast	—
Butter-fat	+++	Vegetable oils	—
Cream	++	Seeds	+ ?
Egg fat	++	Lard	+ ?
Green leaves	++	Nuts	—
Water-soluble B (Antineuritic)Types.			
Yeast	+++	Cod-liver oil	—
Germ of seeds	+++	Vegetable oils	—
Rice millings	+++	Lard	—
Natural grains	++	Butter-fat	—
Nuts	++	Milled products, as rice flour	—
Some vegetables	++	etc.	—
Orange juice . . .	++	Cooked foods	+ ?
Skimmed milk . . .	+		
Water-soluble C Type.			
Lime and lemon juice	+++	Yeast	—
Orange juice	+++	Cod-liver oil	—
Tomato	+++	Nuts	—
Some fresh vegetables	++	Grains and seeds	—
Sprouted seeds	++	Canned foods	+ ?
Fresh unpasteurized milk	+	Cured meats	—
		Cooked foods	+ ?

Table II (also from Emmett) shows the effect of cooking on the vitamin content of certain foods.

TABLE II.—COMPARATIVE ANTISCORBUTIC (WATER-SOLUBLE C) VALUE OF EQUIVALENT WEIGHT OF SUBSTANCES.

Fresh lemon or orange juice (raw)	100
“ cabbage leaves or juice (raw)	100
“ “ “ cooked 100° C. for 20 min.	30
“ “ “ “ 70°–80° C. for 70 min.	10
“ Swede or turnip (raw)	60
“ tomatoes (raw)	60
“ green beans (raw)	30
Potato, cooked 100° C. for 30 min.	7.5
Fresh carrot juice (raw)	7.5
“ beet-root juice (raw), less than	7.5
“ beet juice (raw)	7.5
Dry beans, peas, etc. (raw)	7.5
Fresh cow's milk (raw)	1 to 1.5
Germinated beans, peas, etc. (raw)	30

Emmett states that there is some evidence to show that there may be more than three vitamins. Some observers believe that there are two or three additional ones.

In commenting on the methods needed to determine the presence or absence of any one of the vitamins in a food or food product, Emmett states that the tests necessary require more than ordinary precautions.

The *origin of vitamin A* has been investigated by Coward and Drummond.¹ Seeds in general are deficient in vitamin A. On the other hand, this is known to be relatively abundant in the green, actively assimilating parts of plant tissues. According to Coward and Drummond, there is no increase in vitamin A when seeds are germinated. Nor is there any gain when the latter are etiolated in the dark. Etiolated seedlings and pale-colored leaves deficient in chlorophyll apparently do not synthesize vitamin A; on the other hand, green leaves form it in large amounts. Lower plants, such as marine algæ, containing chlorophyll, synthesize this dietary factor; others, such as weeds, which are differently adapted for photosynthesis, are not so active in this respect; while mushrooms, devoid of pigments, which are concerned with carbon assimilation, are almost completely deficient. The vitamin A in green leaves does not appear to be associated with proteins. It may be extracted in the fat removed by solvents, and appears in that fraction of the fat which is resistant to saponification.

The chief source of vitamin B in our food is the seeds of cereals and other plants, but the factor is removed from cereal seeds in the process of milling. Sugar, sago and other farinaceous products are lacking in B factor, meat and fish are poor and eggs in comparison are rich. Vegetables and milk contain small amounts. The quantity in these foodstuffs is scarcely sufficient to balance the large carbohydrate consumption of white flour in our diet, unless eggs, fruit and vegetables are eaten in great quantities. The products richest in vitamin B are the germ of cereals and yeast.²

In a study of the distribution of vitamin B, Damon³ found that commercial beef extract and peptones are devoid of this substance.

Osborne and Mendel,⁴ in a series of experiments, find that asparagus, celery, dandelion, lettuce and parsley all contain noteworthy amounts of vitamin B. Asparagus proved to be unexpectedly rich in the B type. *Yeast*, which contains vitamin B, has been exploited a great deal and is much used by the laity. Daniels⁵ has employed yeast in the feeding of infants. She found that the most noticeable general effects of the yeast additions, especially with young babies, was the change in the number and character of the stools, a formed "safe" stool, often becoming diarrheal. In many instances not only was the character of the stool changed, but the number per day was greatly increased, even when comparatively small amounts of yeast were used. These frequent diarrheal stools were, in a number of cases, followed by sudden losses of weight, and the results were sometimes so disastrous that it was necessary to institute corrective measures at once. She, therefore, concludes that yeast should not be used as a means of increasing the antineuritic content of infant's food.

The antiscorbutic properties of dehydrated fruits have been studied

¹ Biochemical Journal, 1921, **15**, 530.

² Therapeutic Gazette, 1922, p. 264.

³ Journal of the American Medical Association, July 8, 1922.

⁴ Ibid., April 15, 1922.

⁵ American Journal of the Diseases of Children, January, 1922.

by Eckman.¹ He found that the only one of the dried fruits tested, which contains sufficient antiscorbutic vitamins to maintain the life of a guinea-pig when fed in not too excessive qualities, is peaches. Of this fruit, it appears that 4 gm. a day, although insufficient to prevent scurvy, delays it for three or four months. Apricots and apples have some value, but pears, prunes, loganberries and cherries seemed to have very little. In a similar study, Givens, McClugage and Van Horne² report that the raw apple and the raw banana are antiscorbutic agents. If, however, either of these fruits is subjected to any considerable temperature treatment, such as ordinarily employed in preservation by desiccation or canning, the amount of antiscorbutic vitamin in the original raw material is markedly reduced.

The effect of heat and oxidation on the antiscorbutic vitamin has been studied by Dutcher, Harshaw and Hall.³ They found it is not destroyed by heating at pasteurization temperature (63° C.) for thirty minutes in closed vessels or by boiling (100° C.) for thirty minutes under reflux condensers. Hydrogen peroxide possesses some destructive action when added to orange juice at room temperature and the destructive action is increased when the orange-juice-hydrogen-peroxide mixture is heated at 63° and 100° C.

Chick and Dalyell⁴ report a satisfactory result in stimulating growth and progress of 9 very backward children, varying in age from twelve to thirty-one months, by the use of antiscorbutic juices and of fats containing the fat-soluble vitamin A. Eight of the 9 children treated gave a history of previous attacks of definite scurvy.

WATER-DRINKING AND HYPERTENSION. It is probably true that the majority of clinicians are of the opinion that a large fluid intake (water) is to be avoided in cases of arterial hypertension. It is interesting to note that Oer and Innes⁵ have studied the influence of increased water ingestion on the blood-pressure of some apparently normal subjects, and also in pathologic cases in which there was high arterial tension. They found that the addition of from two to three quarts of water to the normal daily consumption is followed by a distinct fall in both systolic and diastolic pressure. The fall is not accompanied by an increase of either the rate or the force of the heart-beat, and the increased pressure is maintained for some time after the extra water has been excreted. Oer and Innes incline to the view that the chief factor in producing the fall of pressure is the elimination of pressor substances that cause arterial constriction and thereby produce an unnecessary augmented arterial tension.

It is important that this observation be confirmed.

Digitalis. Hatcher and Weiss⁶ believe that nausea and vomiting are of fundamental importance for the protection of various organs

¹ Journal of the American Medical Association, March 4, 1922.

² American Journal of the Diseases of Children, March, 1922.

³ Journal of Biological Chemistry, August, 1921.

⁴ British Medical Journal, December 24, 1921.

⁵ British Journal of Experimental Pathology, 1922, 3, 61.

⁶ Archives of Internal Medicine, May, 1922.

and tissues against digitalis poisoning (using that term in its broadest sense), and different organs have developed this protective mechanism independently of the irritant action which these substances exert on the gastric mucous membrane. They point out that it is especially interesting in this connection to observe that rodents, which are incapable of vomiting, have developed several different, and apparently independent, methods of protecting themselves against the toxic action of digitalis bodies on the heart, and also against the injurious action of various other vegetable poisons. Hatcher and Weiss conclude, from their experiments, that digitalis bodies cause reflex nausea and vomiting through direct action on the heart. The apparent impulses pass from the heart to the vomiting center in the medulla, by way of the sympathetic mainly; in part, by way of the vagus, probably.

Another of the toxic effects of digitalis, namely, cerebral and neuromuscular manifestations, is commented on by Macht and Bloom.¹ They recall that Withering, in his original communication, pointed out that "The foxglove, when given in very large and quickly repeated doses, occasions sickness, vomiting, purging, dizziness, distorted vision effects (appearing green or yellow), increased secretions of urine with frequent motions to part with it, slow pulse (even as slow as 35 to a minute), cold sweats, convulsions, syncope and death." In 1874 Duroziez called attention to the cerebral symptoms, reporting 20 cases in which delirium or hallucinations, with or without death, accompanied the administration of digitalis, and which he believed were caused thereby. It is, of course, recognized that cerebral symptoms in the course of heart disease are not at all uncommon, but it is not sufficiently known that hallucinations, delirium and other mental affections occur at the height of digitalis therapy.

Macht and Bloom, in an experimental study of the effects of digitalis on rats, obtained data which would seem to confirm the clinical observations of Duroziez and others. They believe these symptoms are more common than is generally supposed. Several physicians, whom they have consulted, have had cases in which there seemed to be no doubt but that digitalis was capable of causing these cerebral disturbances.

Christian² believes that the dangers or toxic effects of digitalis are more serious as met with in the text-books than in actual practice. In his opinion, the real dangers of digitalis therapy are these: (1) Using a poor digitalis preparation; (2) consciously, or unconsciously, prescribing too little of a patent digitalis preparation; and (3) not knowing when digitalis should be started and stopped. Christian states that he has yet to see the patient in whom too much digitalis had been given prior to his seeing him. The large majority have had too little digitalis; a small percentage have had enough; none have had too much; and some have had too little from the point of view of dosage when actually they should have had none. In his opinion digitalis poisoning, while possible, is one of the rarities of medicine.

Digitalis is needed when the patient has the symptoms and signs

¹ Archives of Internal Medicine, November, 1921.

² Boston Medical and Surgical Journal, July 13, 1922.

of failing compensation. The symptoms and signs of decompensation are breathlessness, cough, cyanosis, edema, pain, weakness, nausea, vomiting, enlargement of the liver, decreased urinary output, rapid pulse.

The indications for stopping the drug are improvement in these symptoms and signs, or the occurrence of the toxic effect of digitalis. The toxic effects are nausea, vomiting, rarely diarrhea, and certain arrhythmias, as bigeminal pulse and heart-block.

It is to be borne in mind that the digitalis which the patient purchases only too often has but slight potency. In addition, a serious error is to regard a drop as the equivalent of a minim and to prescribe 15 drops of the tincture, thinking to give 15 minims; the patient taking 15 drops often gets but 5 minims, rarely more than 7 minims—both very small doses. This error accounts for much unconscious prescribing of too small a dose; the rest comes from a preparation of low potency.

There should be definite evidences of cardiac insufficiency before digitalis is given. An increased heart-rate alone is never the result of cardiac insufficiency and never an indication of digitalis. Paroxysmal tachycardia does not respond to digitalis, and digitalis does not affect simple tachycardia. No murmur of whatever sort, nor enlargement of the heart, in itself is an indication for digitalis.

Christian states that the digitalis may be given in a single massive dose, or in a modified massive dose method, or in regularly repeated small doses. Any of these methods is effective. The chief difference lies in the length of time needed to produce a result. In his opinion there is no real preference for the average cardiac case. In a few very severe cases the modified massive dose method is preferable, and occasionally the single massive dose may be life-saving.

In Christian's opinion digitalis therapy is very simple. Enough of a potent leaf, prepared in any way, should be given by any accepted method of dosage and the result is most satisfactory in almost every case.

The use of digitalis in 2 cases of *cardiac arrhythmia* following diphtheria is reported by Bile and Schwensen.¹ In addition to the arrhythmia, both children had enlargement of the liver due to the cardiac weakness and arrhythmia. In both cases digitalis was used with the prompt disappearance of the arrhythmia, the tracing became normal with the exception of a few extrasystoles. In 1 case the enlargement of the liver disappeared simultaneously with the relief of the arrhythmia; in the second case the liver became much enlarged, with the onset of the irregular partial heart-block. Bile and Schwensen believe that their experience with these 2 cases makes it probable that in the treatment of these otherwise fatal cases with digitalis in full doses there may be a chance of saving the damaged myocardium from the great exertion caused by the irregularity.

The question of the *potency of digitalis preparations* is a most important one. From time to time analyses are made showing that many

¹ Journal of Infectious Diseases, March, 1922.

samples are inefficient. Bliss¹ reports obtaining fifteen samples of infusion of digitalis, selected at random from retail pharmacies. They showed an average activity of but 42.26 per cent of the theoretical activity calculated from the amount of standardized drug supposedly used in the manufacture of the infusion. Bliss states that five of the fifteen samples prepared by a method that is disapproved of by the medical and pharmaceutical professions (simple dilution of the fluid extract), showed an average activity of 62.6 per cent, or 16.34 per cent stronger than the average of the fifteen samples, and 24.5 per cent stronger than the ten samples supposedly prepared by the U. S. P. (IX method). The last-mentioned samples showed an average activity of but 28.1 per cent.

Eggleston and Wykoff² summarize their conclusions on the absorption of digitalis as follows:

1. The absorption of high-grade specimens of tincture of digitalis from the digestive tract of man is almost invariably sufficiently uniform to permit the establishment of a satisfactory working average total dose in terms of the cat unit of activity per pound of the patient's body weight.

2. Specimens of tincture of average biologic activity are occasionally encountered which are therapeutically unsatisfactory on account of poor absorption from the alimentary canal.

3. Tincture of digitalis shows definite evidences of action on the heart in from two to four hours after oral administration to man.

4. Poorly absorbed tinctures may require more than five hours for the development of demonstrable cardiac action.

5. A method of preparing and standardizing a purified tincture of digitalis is described.

6. The purified tincture is shown to be absorbed from the human digestive tract more rapidly and more nearly uniformly than are different specimens of official tincture of average biologic activity.

7. Considerable variation in the capacity of different individuals to absorb digitalis is shown to exist.

8. Evidence is offered to show that digitalis causes nausea or vomiting in man by reflexes arising in the heart as a result of its intoxication.

9. An average total dose of the purified tincture for oral administration to man is established on the basis of its cat unit of activity and the patient's body weight.

Christian,³ in commenting on the standardization of digitalis in animals, states that it is helpful, but by no means essential.

Emetine. In the treatment of *bilharziasis*, Cawston⁴ claimed the best results for emetine hydrochloride, given intramuscularly daily for three days and then three times a week for three weeks. The initial dose for an adult is 0.5 gr. and for a child 0.33 $\frac{1}{3}$ gr. A dose of 1 gr. is a sufficiently large one to work up to in a child of twelve years. The

¹ Journal of Laboratory of Clinical Medicine, January, 1922.

² Archives of Internal Medicine, August, 1922.

³ Loc. cit.

⁴ Lancet, November 19, 1921.

maximum regular dose for an adult is 2 gr.; larger doses appear to cause toxic effects but to cure more rapidly. Vomiting may occur if the injection is given shortly after a meal. There is a cumulative action of emetine almost as marked as the required tolerance for antimony, therefore the dose should be diminished or given less frequently toward the close of the treatment. The object is to keep the patient under the influence of the emetine without producing undesirable toxic effects. A slight return of albuminuria indicates toxemia and is an indication, just as in the case with antimony, that the dose should be diminished or given at less frequent intervals. As a rule, the treatment should be extended over a period of twenty-five days.

In another communication, Cawston¹ reports an experience with more than 300 injections of emetine hydrochloride. He concludes that when the drug is given skilfully and regulated properly this method of treating bilharzia disease is free from undesirable toxic effects, and is permanently successful in eradicating the infection. He feels that, in view of the difficulty in determining slight cardiac depressions due to the large doses required by adults, the emetine treatment should be confined to children and young persons, and careful attention paid to the pulse-rate throughout. Provided undue exertion is avoided, there is no reason for the patient's being confined to bed. Moderate exercise is useful in determining when the highest dose the patient can comfortably tolerate is reached.

Bonnet² reports a single case of bilharziasis treated with emetine. No living parasites or living ova could be found after the fifteenth injection. The treatment was continued for fifty-three days, the doses being given at intervals. Bonnet states that, aside from the characteristic asthenia under this treatment and tendency to vertigo toward the last, there were no appreciable untoward effects.

In the treatment of *dysentery* with emetine, Jepps³ reminds us that emetine is highly toxic to man and other animals, and as it is necessary for the removal of the amœba to employ the drug in doses of such size that there is in many cases a slight, and in some a severe, toxic effect on the patient. It is because of this that there still seems to be a strong feeling in the minds of some against the use of emetine under any circumstances, in spite of the many series of results now published, in none of which is there any record of more than temporary ill-effects, the drug always being administered under careful medical supervision and stopped when considered advisable.

The following routine is recommended by Jeppe in giving the emetine-bismuth-iodide mixture: The patients were not kept in bed, but allowed to be up and about on a very light diet. The diet consisted of milk, bovril, fish without vegetables, bread and butter and two eggs daily. After the patients were put to bed they received 10 minims of chlorodyne, and half an hour later the dose of emetine-bismuth-iodide mixture in water. They were allowed to have hot tea afterward if

¹ Journal of Tropical Medicine and Hygiene, May 1, 1922.

² Journal d'Urologie, July, 1921.

³ Journal of the Royal Army Medical Corps, June, 1921.

they wished. In this way the vomiting and general discomfort were reduced to a minimum. Vomiting may occur after the first few doses, but is not serious and does not necessitate stopping the treatment. Most of the patients had more or less diarrhea during the treatment.

There were never any cardiac symptoms. In the whole series of treatments (75 cases) the course had to be stopped only on account of severe diarrhea, and in 1 case because of a high temperature which could not be attributed to any other cause. The amount of vomiting is dependent, to a large extent, on ward conditions; a nervous or troublesome patient may easily upset others, and tactful supervision may do a great deal toward preventing it.

Jepps summarizes his conclusions as follows:

1. Salol-coated pills of emetine-bismuth-iodide proved unsatisfactory; 45.1 per cent (at least) of 26 cases relapsed after a twelve-day course of 36 gr.

2. An emulsion of emetine-bismuth-iodide in liquid paraffine gave much better results. Of 63 cases given a twelve days' course of 36 grains, only 12.7 per cent relapsed. After retreatment of a few of these relapsed cases with a double course, 11.1 per cent were still uncured.

3. Further analysis of these figures shows that of 57 cases showing no intestinal symptoms, or only slight symptoms, 3.5 per cent had not been cured; while of 6 acute and subacute cases 5, or 83.3 per cent, had remained positive.

4. Injections of emetine hydrochloride were found very useful in cases where the emetine-bismuth-iodide treatment could not be tolerated. Three out of 5 cases were cured by a course of twelve daily injections of 1 gr. each.

5. The treatment proved beneficial to the patient's general condition, and there were no permanent ill-effects.

Soca¹ reports a fatal case of *polyneuritis* following eighteen days of treatment, with a total of 1.05 gm. of emetine for dysentery. He states that he has observed a number of cases exhibiting toxic symptoms and that these were regularly observed when the dose of 8 cg. was repeated for several days in succession.

A complete and permanent cure of an amebic liver abscess with emetine alone is reported by Tolzi.²

Endocrines. Hoskins³ sounds a timely warning in regard to the indiscriminate use of the gland products and to emphasize the fact that the problem is a very complicated one. There is still much to be learned. As he states: "Little is to be expected from nonchalant attempts to solve these problems by superficial observations. Nor can a thoughtful clinician take seriously the claim that overenthusiastic use of gland products is to the best interest of the patient. The arguments adduced are precisely the stock arguments of the cultists and nostrum venders. Ultimately, practical organotherapy will have to be reduced to a statistical basis. This will require the accumulation of

¹ Bulletins de la Société Médicale de Hôpitaux, May 12, 1922.

² Policlinico, May 15, 1922.

³ Journal of the American Medical Association, July 8, 1922.

a much greater fund of well-established observations, both positive and negative. There is need for many more careful studies of individual cases as well as extensive series of cases. Almost any endocrine case presents a research problem worthy of exacting study."

Hoskins advocates the establishment of a hospital or clinic especially equipped to make an intensive study of endocrinology.

Ether. The effects of ether on respiration has been studied by E. P. Smith.¹ Using concentrations of 1, 3.65 and 7.3 per cent, he noted that the first effect is to cause a depression in the respiratory rate. This is followed by a rapid rise above normal, which, in turn, is succeeded by a fall. With all the concentrations the respiration is ultimately reduced to approximately the same level; the stronger the ether, the less time required to produce this result. Even when the respiration has been reduced below normal, recovery is possible on removal of the ether, and appears to be complete, if sufficient time is allowed. If, however, the rate has been too far depressed no recovery is possible.

Ether is recommended by Vaccarezza and Inda² in the treatment of *whooping-cough*. The amount injected varies from 0.5 to 2 cc, according to age. The drug is injected intragluteally every day for three days and then on alternate days. Three injections are often all that is needed. Sometimes the heart-rate is accelerated for about an hour. According to these authors, the course of the disease is shortened, and, in the favorable cases the cough loses its spasmodic character.

Exercise and Rest. The employment of these two agents in the treatment of pulmonary or, in fact, any form of *tuberculosis* is not as well understood by many practitioners as it should be. And this is in spite of the fact that the literature on the subject is enormous. The prevailing mistake is to neglect the rest and prescribe or permit of exercise at a time when the latter is usually harmful and in many cases actually disastrous. On the other hand, there can be no doubt but that rest is carried to an extreme in some cases and, having first been useful, later becomes harmful.

The only safe-working rule is to institute treatment in all cases with a period of rest in bed. Generally speaking, this should be a month. During this period one then has the opportunity of gauging the degree of toxicity present, particularly the amount and the character of the fever. If fever is absent exercise can be undertaken safely in a very short time; if fever has been present, but quickly subsides, with rest in bed, exercise can be advised after a brief period. On the other hand, persistent fever, marked loss of weight, nervous exhaustion as manifested by malaise and often mental depression does not permit of exercise or even of the patient's sitting up. Rest must be persisted in. The only exception to this rule is in the case of the hopelessly advanced disease in which nothing is to be hoped for no matter what is done. The main problem with this type of case is to make him comfortable.

¹ Journal of General Physiology, November, 1921.

² Semana Medica, October 6, 1921; Abstract, Journal of the American Medical Association.

One thing is certain, no man ever acquires the ability to determine at the time of the initial visit how long rest must be carried out, or to estimate with any degree of accuracy how active the disease is. At the end of a month's rest in bed a fairly accurate opinion may be hazarded.

Much the same opinions have been expressed in an editorial article.¹ For some years I have alluded to the fact that the so-called rest-cure treatment for nervous and mental disturbances, as introduced by Weir Mitchell, was in reality the foundation of our modern method of treating pulmonary tuberculosis. Mitchell, in his original presentation of the subject, in 1876, included in his case histories many cases of obvious tuberculosis, and others in which it was clear that a latent tuberculous process was at the bottom of the nervous exhaustion or neurasthenia. The fundamental principles of the rest treatment are rest, generous feeding, isolation from business and social distraction, and, in certain cases, the use of electricity and massage. Omitting the last-mentioned agents, you have the modern method of handling tuberculosis. The editorial referred to regrets the fact that the Weir Mitchell method has been, as a rule, limited to cases of nervous exhaustion. As a matter of fact, the method is largely applied as I have stated without any appreciation of the source.

I have already alluded to the fact that in not a few instances, patients are kept on rest too long. In such cases they are apt to take on too much weight, and, furthermore, weight that is not beneficial. They are fat and flabby and unable to stand anything. What is far worse, they only too often become profoundly neurasthenic, are afraid to move, become self-centered and selfish and a burden to themselves and everyone around them. The second state of many of these people is worse than the first. They have had the tuberculous lesion arrested, but are prevented from resuming a normal life, because of their physical and nervous condition. It often takes considerable effort and skill to overcome these handicaps.

The effects of exercise in *heart disease* have been studied by Peabody and Sturgis.² They made a study of dyspnea on 11 ambulatory patients with heart disease, and a similar group of normal subjects while standing at rest. They found that the oxygen consumption and heart-rate were slightly greater in the former. Also, under the same conditions, the minute volume of the respiration was much greater in the patients with heart disease and the breathing was more rapid and more shallow. The slight amount of exercise involved in walking up sixty steps produced the same relative changes in oxygen consumption, pulmonary ventilation and heart-rate in both groups, but it caused more subjective dyspnea in the patients with heart disease. Exercise which was severe enough to cause a corresponding amount of dyspnea in normal subjects caused the same type of changes in oxygen consumption, pulmonary ventilation and heart-rate, but they were greater in degree.

Shortness of breath in heart cases was most noticeable immediately

¹ Therapeutic Gazette, 1922, p. 32.

² Archives of Internal Medicine, March, 1922.

after exercise was stopped, and at this time the pulmonary ventilation was largest. It is suggested that the two factors which account for the greater dyspnea in the cardiac patients are the inadequate circulation, which results in a delayed elimination of carbon dioxide, and the tendency to shallow breathing, which necessitates a relatively large pulmonary ventilation.

Starling¹ states that in the management of *failure of compensation* the most important factor is rest, which not only diminishes the demands on the heart from the arterial side, but by removing the main cause for the return of blood to the heart enormously decreases the inflow into this organ; and it is inflow which in the healthy heart determines output.

Starling believes that another factor of great importance in enabling the heart muscle to recover its physiologic condition is the circulation through the coronary vessels. The most important factor in determining the amount of blood flowing through the coronary arteries, and therefore the oxygen supply to the heart muscle, is the arterial pressure, so that as the resistance to the heart-beat increases there is a corresponding increase in the flow of the blood through the heart muscle.

Starling states that the enormous range of adjustment in the coronary circulation characteristic of the healthy heart enables us to form some idea of the evil results which must follow impairment of the power of adjustment, such as may occur in consequence of disease of the coronary arteries themselves. We may see how rapidly such a failure of adjustment may act on the heart muscle by repeating Cohnheim's experiment of ligature of one main branch of the coronaries. This is almost invariably followed within a period varying from a couple of minutes to half an hour, by the fibrillation of the ventricles and death of the animal, and a similar result may occur in man as a result of any unequal derangement in the powers of adjustment possessed by different parts of the coronary system.

Starling is inclined to ascribe the beneficial effects of graduated exercise in heart disease very largely to improvement of the coronary circulation brought about by the temporary rise of arterial pressure accompanying the exercises.

Heliotherapy. Although it has been known for some years now that the effect of the sun's rays, and even of artificial lights, has a most potent effect on various diseased conditions, the medical profession as a whole has been backward in availing itself of this powerful therapeutic agent. Recently the subject has been forcibly brought to the attention through the indisputable demonstration by various investigators, both here and abroad, that sunlight, and notably the ultra-violet rays, have a marked curative effect on certain forms of rickets, as well as a prophylactic influence when this disease is apt to develop.

Considerable work has been done in the attempt to obtain information on the possible chemical reactions associated with these various light effects, particularly on the ultra-violet rays. So far, it would seem that these rays may act on proteins, so as to render them less

¹ Lancet, December 10, 1921.

soluble. The harmful effects of light on bacteria may depend on such changes in the protein constituents of their living protoplasm. For instance, solutions of albumin in quartz vessels behave like solutions of the more readily precipitated protein globulin after being subjected to ultra-violet rays. Ordinary glass is a barrier to these potent rays, a fact which should always be borne in mind in contrasting the possible effects of sunshine indoors and outdoors.¹

DeGroer² states that exposure to the sun's rays produces a typical hemoclastic crisis, but this is transient, and is followed by a leukocytosis. When only a well-tanned region is exposed to the rays the hemolysis does not occur, the pigmentation evidently protecting against it. From this he concludes that the regions exposed should be systematically arranged so as to have always some non-tanned region available.

DeGroer likens the effects of the rays to parenteral protein therapy. He states that the changes apt to be induced throughout the organism by the exposures to the chemical rays can be demonstrated by the Schick test. He inoculated the back with diphtheria toxin, four and two hours before the test, during the test and again two and four hours afterward. Instead of completing the test with antitoxin, as in Schick's original method, he exposed the abdomen to the chemical rays, and gives an illustration which clearly shows the difference in the reaction when the system is, or has been, recently under the influence of chemical rays. Every exposure to them acts like a poison on living matter. Besides the local inflammatory reaction, the absorption of products from the damaged cells induces a general reaction. The mechanism of protein poisoning from an extensive burn, according to De Groer, differs only in degree from that induced by the action of sunlight or mercury vapor light. As previously pointed out, the great interest in heliotherapy at present is its curative and prophylactic powers in the management of *rickets*.

Hess³ points out that one must bear in mind constantly that rickets is preëminently a seasonal disorder, and that it is characterized by a striking seasonal variation. Clinicians as well as pathologists are in complete agreement as to its marked incidence in the winter and spring, and comparative rarity in the summer. In his own experience three-quarters of the cases develop during the first half of the calendar year, and but one-quarter during the second half, and that almost all of the latter are observed late in November and in December. This seasonal factor is climatic, not dietetic, and due almost entirely to lack of sunlight.

Another noteworthy factor is the pigmentation of the skin. It has been shown experimentally that if two groups of rats, one composed of white rats, and the other of black rats, are given the minimal protective dose of light it will be found that although diet and rate of growth have been the same, the black rats will develop rickets, whereas the white rats will show no rachitic lesion. This is borne out in infants.

¹ Journal of the American Medical Association, July 1, 1922, p. 42.

² Annales de Médecine, January, 1922.

³ Journal of the American Medical Association, April 22, 1922.

Negro infants require a greater degree of the effective light rays than do white infants. That they possess no racial predisposition to rickets is evidenced by their freedom from this disorder in their native homes in West India. Hess also believes that the darkness of the skin is a predisposing factor also, in the susceptibility of the Southern Italian, the Syrian and other southern races. He does not imply from these statements that susceptibility is merely a question of degree of pigmentation of the skin, but rather that light is an important etiologic factor in determining the efficacy of light.

In an article on the care of infantile rickets by sunlight, Hess and Gutman¹ give the following directions:

The infants were placed in the direct sunlight for from one-half hour to several hours, the period varying according to the sun's intensity, the clemency of the weather and the sensitiveness of the baby. It is necessary that the sunlight be direct, and not transmitted through clothing or through the window glass; otherwise it loses the greater part of its curative potency, as the result of filtering out the effective rays. As has been stated in a previous communication, such treatment cannot be carried out in a routine manner, but must be varied according to the condition of the babies, some of whom are far more sensitive to sunlight than others. At all times, care was taken that the infants were warm. It was found quite sufficient to expose the arms and legs, although it is preferable, when the temperature permits, to expose the trunk as well.

Previous to treatment, the majority of infants showed the clinical symptoms of mild rickets, characterized by beading of the ribs, and the characteristic changes in the epiphyses are seen by roentgen-ray examination. All the children were receiving the customary milk mixtures and orange juice, the older ones getting cereal in addition. Reliance was not placed entirely on the roentgen-ray examination of the bones, as it has been our experience that infants may manifest the classical signs of rickets, accompanied by a low inorganic phosphate of the blood, and, nevertheless, show normal bony contours at the wrists and other joints.

In every instance in which heliotherapy was employed the rachitic signs diminished, as was demonstrated clinically and by roentgen ray, and the general condition improved.

In addition, Hess and Gutman found that, as the condition improved, the inorganic phosphate of the blood was gradually restored to the normal level. This result is similar to that which has been attained by means of cod-liver oil, which must be considered a specific for this disorder.

Powers, Park, Shipley, McCollum and Simmonds² report the results of an experiment on the effects of sunlight in the prevention of rickets in rats. Their results are summarized as follows:

1. The object of the experiment was to determine whether or not sunlight prevents the development of rickets in the rat.

¹ Journal of the American Medical Association, January 7, 1922.

² Ibid., January 21, 1922.

2. A diet was employed which at room light regularly gives rise to a disease in its essential features identical with rickets as seen in human beings. The diet was high in calcium, low in phosphorus and was insufficiently supplied with fat-soluble A. In other respects it was well constituted.

3. Eighteen rats were placed on the diet. Twelve were exposed to sunlight for a total of two hundred and forty-two hours over a period of sixty-two days. Six were kept under conditions of ordinary room light as control animals.

4. The control rats, killed with ether at the end of sixty days, all showed rickets.

5. The rats exposed to sunlight, killed coincidentally, remained without exception entirely free from rickets. The absence of the lesions of rickets was confirmed by histologic examination.

6. The beneficial effects of the sun's rays were not limited to the skeleton, since the condition of the animals underwent a general improvement under the influence of the treatment with sunlight. The effect of the sunlight on the skeleton was a manifestation of its favorable effect only on a single tissue.

7. The exposure to the sun's rays, however, did not entirely compensate for the defects in the diet. The animals remained undersized; the bones, though completely calcified, remained thin. Though the sunlight did not alter the defects in the diet, it permitted the animals to thrive to a limited extent in the presence of them.

8. It is necessary to conclude, therefore, that the sunlight in some way raises the efficiency of the body cells. It enables the organism to put into operation regulatory mechanisms which otherwise would have been inoperative or ineffectual.

9. The effects of sunlight and of cod-liver oil on the growth and calcification of the skeleton and on the animal as a whole seem to be similar, if not identical.

Lovett,¹ in commenting on the various factors which are of benefit in the treatment of rickets closes as follows: "Recent investigations have shown that there is a real basis for the empirical teachings of the past that out-of-doors, phosphorus and cod-liver oil were of use in the treatment of rickets. They leave us somewhat in the dark, however, as to how to prevent it. It would seem, sunlight being beneficial only when it strikes directly on the body, as if it was not sufficient to keep babies in airy, sunny houses, but that their naked bodies must be wholly or partly exposed to the sun's rays. It will be rather difficult to persuade the average mother to do this regularly in the winter, as a preventive, although she will probably do it gladly as a curative measure. These investigations show us little or nothing as to how a baby should be fed to prevent the appearance of rickets. It still seems safe, however, to follow the old teachings that human milk is the best food for babies, and, next to it, some modification of cow's milk. It may be that the time will come when all babies will be given

¹ Boston Medical and Surgical Journal, April 13, 1922.

cod-liver oil as a preventive. It seems evident, at any rate, that cod-liver oil will cure rickets. As it is the easiest and simplest method, it would seem to be the one of election. *Phosphorus* also seems to have a definite curative action. It is, however, a dangerous drug and the limits of its dosage narrow. It is, therefore, inferior to cod-liver oil for ordinary use."

One of the first diseases in which heliotherapy was applied was *tuberculosis*, especially the so-called surgical type. Turnbull¹ has reported the use of sunlight in the treatment of children having or suspected of having tuberculosis. The majority of the children under Turnbull's care were of the so-called pretuberculous type. About 10 per cent had tubercle bacilli in the sputum and an additional 10 per cent had toxic symptoms or surgical complications necessitating special care.

In applying the treatment, a special class was made of the sick children and those with surgical complications. These were placed on blankets on the lawn under the care of a nurse. Their exposure to the sun was regulated according to the principles laid down by Rollier, the lower extremities being exposed for fifteen minutes the first day, the time of exposure and the area exposed being increased from day to day. After exposure of the entire naked body was secured, an arbitrary maximum of three hours' exposure daily was decided upon, this being divided into two exposures of not over one and a half hours each. The nurse was held strictly responsible for avoiding sunburn. It was found that different types of skin reacted very differently in this respect and that great care was necessary during early exposure.

Turnbull states that, contrary to what they feared, there were no bad results from the sunlight, even in the positive sputum cases. In only 2 cases was there a tendency to headache and rise of temperature after exposure. In both cases this was controlled by protecting the head and eyes by a straw hat.

The good results were shown by disappearance of cough, increased appetite, increased muscular development even in cases taking no exercise, greater regularity of temperature and decrease of pain in surgical cases.

In handling the large pretuberculous group a modified method was adopted. The boys were dressed in the lightest cotton bathing suits that could be procured. For the girls, a loose-fitting, one-piece, bifurcated garment was made, reaching from the angles of the scapulæ to the middle of the thighs, and held up by narrow shoulder straps. Shoes, stockings and underclothing were discarded. These suits were worn constantly at school and at play.

Turnbull feels that, while it is inadvisable to be too positive as to the relation between cause and effect, it is the opinion of those who have been caring for the children in his institution for some years, that they have never done so well or improved so rapidly as they have during the past two years. The two most notable effects were the

¹ Therapeutic Gazette, May, 1922.

filling out of wasted arm and shoulder muscles and the disappearance of glandular enlargements. In addition, the children have been remarkably free from ordinary colds and nasal infections, in spite of the fact that they have worn their scanty uniforms on the playground during rain as well as in the sunshine. He also applied heliotherapy in 25 cases of active pulmonary tuberculosis. He thinks the results so far obtained are sufficiently encouraging to continue the method in this type of case.

Turnbull points out that since sun exposure is necessary for the proper growth of plants and animals, it is a logical therapeutic agent in disease characterized by low vitality. In pulmonary tuberculosis of children, graduated sun exposure appears to be free from danger and to give excellent results. In the so-called pretuberculous cases the results are better than those from any other line of treatment. In adults the results may be considered encouraging. Turnbull's experience indicates that the dangers of properly graduated sun exposure in pulmonary tuberculosis have probably been overdrawn by some writers.

A combination of sea bathing and heliotherapy is advocated by Gauvain¹ in the treatment of *surgical tuberculosis*. He first allows ambulant patients to paddle for increasing periods; later they are sprayed with cold sea water over increasing areas of the body and, finally, full immersion is permitted.

Recumbent patients are first sprayed and later immersed, as their condition permits, for carefully graduated periods. A brisk reaction is sought, and this is hastened by taking each patient from the sea and placing him within a protected enclosure where he is wiped down before the radiant heat of an open coke brazier. The patient's feet are placed in warm water and he is given a hot drink. This is followed by a sun bath.

Gauvain states that the stimulating effect of this procedure is remarkable. The immersion in the sea water is followed by deeper respirations of great amplitude, which effectually expand the lungs and expel waste products. The circulation is also favorably affected. The first chilling effect causes a constriction of the superficial capillaries, followed, when reaction occurs, by their dilatation. All parts of the body are flushed by an increased volume of blood and lymph, the blood supply to diseased tissues likewise increasing. Excretion from the lungs, skin and kidneys is increased.

Gauvain believes that sea bathing followed by a brisk rub and a graduated sun bath produces a sense of exhilaration and well-being, and physical improvement much greater than the sun treatment alone. This is especially true of *lupus*.

Kern² favors the use of *actinotherapy* in conditions calling for heliotherapy. He states that the ultra-violet rays are antiseptic, bactericidal, markedly analgesic, a sedative to the nerves and that they assist in promoting general metabolism. In tuberculous patients it is prefer-

¹ British Journal of Tuberculosis, July, 1922.

² Ohio State Medical Journal, April, 1922.

able to the natural sunlight on account of its applicability at all places and in all climates. It is especially so in cases that must be treated in their homes.

The actinic rays are especially valuable in the treatment of *neuralgia* and *neuritis*. Kern states that in these conditions immediate relief is afforded in many cases. In chronic cases the actinic rays must be continued for a prolonged period in order to obtain results.

In a review of the subject, Ahlswede¹ points out that the lack of sufficient sunlight in northern Europe led to the search for adequate substitutes. These were found chiefly in the shape of the Finsen lamp, and the mercury-vapor lamp. According to Axel Hensen and Johansen, the Finsen light most nearly approaches sunlight in its effect. It contains the same proportions of short-waved rays and long-waved penetrating rays provided the filament in the arc light is exactly composed. The mercury-vapor lamps, on the other hand, differ from the light of the sun inasmuch as they show a line spectrum compared with the continuous uninterrupted spectrum of the sunlight.

The biologic and therapeutic effect of rays on the skin depends on their wave length. The shorter the wave length, the shorter the effect on the surface of the skin. The superficial layer of the epidermis absorbs the short-waved rays; at the site of absorption a strong superficial influence is seen. The long-waved rays, on the other hand, are more penetrating and go deeper into the subcutis and body. It is, therefore, necessary to cut off the mercury-vapor spectrum at a certain wave length to get as near as possible to the spectrum of the sun.

It is advisable to use mercury-vapor lamps at one yard distance, but in cases in which a stimulating effect is desired (wounds) the short-waved ray may prove useful.

Ahlswede states that the effect of light on an unprotected skin shows the following visible degrees of intensity: Erythema due to heat; inflammation due to light; and pigmentation. The erythema is seen immediately after exposure of skin. It shows a hyperemia which rarely lasts more than an hour and then disappears. Mercury-vapor lamps do not cause this reaction as heat rays are not contained in their spectrum.

The inflammation of the skin by light is generally seen in from five to ten hours after exposure. The degree of the inflammation depends on the length of exposure and the intensity of the light.

As to the pigmentation, this is generally seen two to five days after the exposure to light. It is a defensive action of the system against the light; the erythema gradually turns darker, almost brown and the skin begins to peel off. The skin gets accustomed to the light and its sensibility decreases to a degree which renders an inflammation of the skin, even after long exposure to intense rays, impossible. This, however, can be said only with regard to the Finsen light and sunlight. Mercury-vapor rays always cause erythema; the skin cannot become immune to their influence.

¹ Urologic and Cutaneous Review, September, 1921.

It is to be borne in mind that light has its effect in the body and not alone on its surface. It has been shown that the Finsen light caused an increase of hemoglobin and the red blood corpuscles. Hertel showed that, under the influence of light, hemoglobin passes its oxygen on to the tissues more quickly. The bactericidal power of light is well known. That internal organs may be influenced is indicated by the fact that the ultra-violet rays cause changes in the spleen in mice, followed by an increase of giant cells.

Amstad¹ points out conditions which are especially benefited by heliotherapy. He emphasizes the beneficial effect of the treatment on the entire system as evidenced from the improvement of the blood picture. In 17 cases of *lymphogranuloma* systematic heliotherapy arrested the disease for a year or two, and the general condition was immeasurably improved. These patients had all been sent to him as cases of advanced glandular tuberculosis. He believes that in an earlier stage heliotherapy offers prospects of a complete cure.

Rickets is cured by sunlight, and Amstad believes it should be applied more generally in order to prevent the appearance of the disease.

The treatment of *wounds* by exposure to sunlight is too much neglected in Amstad's opinion. He begins after three days to expose the wounds to the sun, holding them open with retractors; even large defects heal over in ten or twelve weeks.

Amstad deplores the dependence on drugs and the neglect of such natural resources as sunlight, particularly in dealing with wounds and the giving of sun baths to infants in order to prevent rickets.

Hexamethylenamine. In a study of drug therapy in *pyelitis*, Helmholtz² states that in acute cases the alkalies are useful, but there is no evidence of any direct specific effect, except possibly a diuretic action. From a study of the literature, Helmholtz has gained the impression, especially in the *pyelitis* of infancy, that hexamethylenamine is not of much value. His own conclusion is that while the drug has a very definite bactericidal action in the bladder, it has not been demonstrated that this is also true of the pelvis of the kidney.

Hydrochloric Acid. In the treatment of *pernicious anemia*, Bil³ advocates the use of hydrochloric acid in order to restore normal conditions in the stomach and upper part of the small intestine. He introduces once a day, on an empty stomach, by means of a thin sound (6 mm. in diameter), a hydrochloric acid solution of about the same strength and volume as the acid secreted after a meal. This procedure, he believes, brings about an acid reaction in the upper part of the small intestine, which tends to hinder, or to diminish, pathologic decomposition of the intestinal contents by ridding it of bacteria.

McClure and Ellis⁴ are of the belief that dilute hydrochloric acid is not, in acid-sensitive cases at least, the harmless tonic the text-books would lead us to accept. In their opinion when the acid is being

¹ Schweizerische med. Wochenschrift, January 26, 1922.

² Journal of the American Medical Association, July 22, 1922.

³ Lancet, April 1, 1922.

⁴ Ibid., August 6, 1921.

administered the blood-pressure should be estimated from time to time and the urine occasionally tested for its acid and ammonia relations.

If an early renal insufficiency is suspected the "rest urine" should be compared with the "alkaline tide urine" in respect to their relative acidity.

McClure and Ellis state that acid largely regulates the amount and character of the urine excreted by its action on the renal tissue. This is largely controlled by the increasing acidity of the blood (acidemia), tending to raise the blood-pressure; otherwise the kidneys would not be able to maintain the necessary balance between acid and alkali. When kidney impairment takes place, owing to the breakdown of the chemical balance, general acid sensitiveness occurs, and this is accompanied by a rise in blood-pressure. If, however, the structure of the renal cells is not injured, this is not maintained unless the acidemia continues. On the other hand, if the structure of the cells is injured the rise of the blood-pressure is more or less permanent until other forms of compensation are established. If this state of affairs arises the administration of acid and acid-feeding are contraindicated. In doubtful cases the blood-pressure should be watched to avoid overdosing with the acid. The latter is indicated by the "alkali-tide urine," approaching the "rest urine" in character.

McClure and Ellis assume that the reason why, during the administration of acid, a rise in blood-pressure is not easily reversible, that is, followed by a more or less similar fall, while this subsequent fall in blood-pressure is not easily reversible, is because acidosis may be transferred to the tissues, the acidemia thus being changed into a histacidosis, and this causes a fall in the blood-pressure. If histacidosis occurs it is not easy to raise the blood-pressure again, because of the difficulty either of raising the acid content of the blood above that of the tissues, or of reducing the acidity of the tissues below that of the blood, the fluid pressure thus persisting toward the tissues, while the balance is against the blood.

Iodides. The use of iodides in the treatment of the mycotic infections is a recognized procedure. In the treatment of oidiomycosis (blastomycosis), Farnell¹ recommends the intravenous use of hypertonic iodides. He used *sodium iodide* exclusively in at least 400 injections. The preparation is made in from 8 to 13 per cent (10 per cent is the usual strength) solutions in distilled water, to the amount of 100 cc. This is then boiled and cooled, and given by gravity intravenously. The solution is freshly made for each treatment. Farnell states that in this way a distinctly hypertonic solution of high concentration is produced. He did not note in any case irritation of the digestive tract; skin eruptions occurred in 1 case and coryza in another. He believes that iodine injected with the blood stream in hypertonic form has a tendency to reduce the idiosyncrasy toward iodism. In addition to benefiting the mycotic infections, iodides given intravenously in concentrated form appear to help materially the action of arsphenamine on the diseased tissues and cells.

¹ Archives of Neurology and Psychiatry, June, 1922.

Iodine has been so generally approved as an efficient skin antiseptic in emergency operations and in the first-aid treatment of wounds, that it comes as a surprise to learn from Colcord¹ that the method is not without its faults. He states that the iodine destroys a layer of tissue over the wound surface without selection, and that this must be removed before healing can begin. Furthermore, it furnishes a favorable culture medium for bacteria. He asserts that the teaching that every individual wound is potentially infected is misleading and has done harm. With proper cleaning and débridement, almost every such wound will heal without clinical infection, the body cells and fluids taking care of the usual bacteria remaining. Mechanical débridement with forceps and knife or scissors should be done, and this followed with the application of *sodium hypochlorite solution*.

Colcord is opposed to the teaching that employees should be permitted to treat wounds when well-equipped dressing stations and trained nurses and surgeons are available. He thinks the dictum that iodine should always be applied at once before sending the man to the doctor is a pernicious one. Such a course is permissible only when several hours must elapse before the man can be seen.

Iodine, he states, has been shown to be far inferior to Dakin's solution, Ochsner's fluid or dichloramine-T. Silver nitrate, bichloride of mercury, iodine and carbolic acid coagulate albumen and favor infection. They also, by this very infection, block up the lymph channels and so prevent the outpouring of lymph into a wound, so necessary for its germicidal powers.

What is necessary in industrial surgery is clean technic, through cleansing, proper suturing, drainage, splintage and rest.

Iron. The value of iron in the treatment of *anemia* continues to be the subject of controversy, despite the fact that most physicians and the laity in general are of the belief that iron is of service in dealing with impoverished blood states. Experience has shown that, as a rule, unnecessarily large doses are too often given. The one exception to this seems to be in the chlorotic type of anemia, in which large doses do seem to be essential, although the reason does not seem clear.

The failure of iron to favorably affect anemia has been the subject of experimental studies. Whipple and Robscheit² produced secondary anemia in dogs by bleeding, and then carried out a very exhaustive study as to the influence of various preparations of iron in the regeneration of the blood. These investigators claim that their experiments give no support to the time-honored custom of administering iron and certain other drugs in conditions of simple anemia, and that the burden of the proof rests with those who claim that any given drug is potent under such conditions.

They do not deny that patients who are taking iron and arsenic improve but this they attribute to dietetic conditions rather than the drugs.

¹ International Journal of Surgery, April, 1922.

² Archives of Internal Medicine, 1921.

Musser¹ studied animals which had been repeatedly deprived of small amounts of blood over various intervals of time, and thus rendered anemic. The anemia that these animals showed represented the type of anemia which occurs after recurring loss of small amounts of blood and the type which the physician is called in most frequently to treat.

Musser administered to these animals iron in the form of equal parts of ferrous sulphate and sodium bicarbonate, in quantities equivalent to 2 gm. (30 gr.) of iron a day for man. His results coincided with those of Whipple and Robscheit in that the dose of inorganic iron failed to produce any constant alteration in the course of the experimental hemorrhagic anemias.

Hare,² in an editorial comment on the work of Whipple and Robscheit, points out that pharmacologic investigations on animals are of the greatest possible value in that they increase our general knowledge and often correct error. On the other hand, he protests against the laboratory investigator lightly brushing away the experience of thousands of clinicians after making a few experiments upon animals, not that the results obtained are valueless or lacking in interest, but because the two sides of the evidence have not been adequately considered.

Again, Hare states, that "What the clinician needs is not alone investigations which seem to disprove the value of things in which he has confidence, but investigations which go far enough to not only correct him, but to explain matters which are obscure, and, in addition, at least offer a substitute for the remedy which has been claimed to be without value."

Kaolin. China clay, bolus alba, or kaolin, is aluminum silicate, a salt insoluble in water, with crystals of 1 micron in length in a fine state of division. Walker³ states that it was in use in early Roman times and was also used by the natives of the Orinoco. It has also been employed in diphtheria in Germany as a powder insufflated on the fauces and tonsils, and also a mixture internally. It has also been used in a variety of gastro-intestinal disorders, namely, ptomaine poisoning, dysenteries, summer diarrhea of children and toxic conditions. Walker reports on its use in the treatment of *Asiatic cholera*. He refers to Kulme's work in the Balkan war (1913). By the use of kaolin, Kulme claims the mortality was reduced from 60 to 3 per cent. His method of preparation was as follows: A suspension was made of equal amounts of kaolin and water, the kaolin being stirred into the cold water. Half-pint doses of this suspension were taken half-hourly for the first twelve hours; the second twelve hours several glasses were taken, according to the patient's condition. Vomiting soon ceased, the pulse improved and the patient slept. The general effect of the salt seems to point to the absorption of toxins.

Braafladt, in an epidemic in China, in 1919, gives the following results of various treatments:

¹ Archives of Internal Medicine, November, 1921.

² Therapeutic Gazette, November, 1921.

³ Lancet, August 6, 1921.

1. Hypertonic saline treatment, after the method of Rogers, gave a mortality of 22 per cent. Convalescents discharged on the eighth day.

2. Kaolin and hypertonic saline treatment gave a mortality of 29 per cent. Convalescents discharged on the sixth day.

3. Kaolin treatments alone; mortality, in 35 cases, 1 patient (this patient died of gangrene of the uterus after miscarriage). Convalescent patients discharged after four days.

All these patients had true cholera vibrios, being isolated during their stay in the hospital. Walker states that the advantages of the kaolin treatment are: (1) Simplicity of method; (2) absence of relapse; (3) cessation of loss of fluid; (4) great improvement in the condition of the patient from the absorption of toxins, the patient becoming rapidly free from a general "toxic condition;" (5) early return of the passage of the urine; (6) early and rapid convalescence.

In a series of 75 cases, from a village two hours' journey from the hospital, Walker had no fatalities, and this result was obtained in spite of the fact that many of the patients arrived at the hospital in a condition of extreme collapse. The mortality of untreated cases at this village was stated by the village headman to be exceedingly high, though he was unable to obtain exact figures owing to the absence in China of any registration of deaths.

The kaolin aids, by absorbing toxins and coating the entire body, enmeshing the vibrios.

Luminal This drug came prominently to the front a few years ago as a nervous sedative, particularly in the treatment of *epilepsy*. During the past year a number of articles have appeared on its use.

Luminal is phenylethyl-malonylurea, or a derivative of veronal, in which one of the ethyl groups is replaced by a phenyl radical. Luminal sodium is a soluble derivative of luminal and may be given in hot milk or water, in doses of 1 to 2 grs. once a day, usually at bed time.

Continental observers consider 3 or 4 grs. daily safe, provided the patient is under proper supervision.

Fox¹ employed sodium luminal in 16 cases of ordinary epilepsy in children or adolescents. There was a marked reduction in the fit incidence in every case. This uniformity of reaction to the drug places it, according to Fox, in a category apart from other antiepileptic remedies.

Luminal sodium seems to give the best results in cases liable to major epileptic attacks. Cases which suffer from momentary losses of consciousness, or from periodic short attacks of altered consciousness with automatism, are notoriously inaccessible to drug treatment. Even in this type of case, Fox obtained some good effects. Fox warns that sodium luminal is not to be looked upon as a curative agent, but simply as one that, at its best, only arrests, or limits, the frequency of the convulsive attacks.

Austin² has employed luminal in a group of 49 epileptics for fifteen months. The daily dose was from 1 to 5 grs. In common with others

¹ Lancet, September 10, 1921.

² Ohio State Medical Journal, October 1, 1921.

who have employed the drug, Austin does not consider it a curative agent, but simply one that will ameliorate the seizures. So far, the drug has given better results than any other remedy employed in the treatment of the essential epilepsies. Those patients who received the luminal are in as good physical and mental condition as at the beginning of the treatment and many are much improved. No untoward results were observed.

In a series of 50 cases of epilepsy Small¹ reports 80 per cent responding well to the luminal.

Stanton² administered the drug to 100 epileptics. In practically all cases there was a diminution in either the number or severity of the seizures, and in many instances the seizures disappeared. Stanton believes that luminal, accompanied by bromides in the early stages of the treatment, gives better results than luminal alone. If a rapid effect is desired, Stanton states that it is possible to use the luminal sodium preparation in a 20 per cent solution subcutaneously.

Austin³ also recommends the drug subcutaneously in doses of from 1.05 to 5 grs. in cases of status epilepticus and mania; in the same states 5 to 10 grs. may be given per rectum.

In some cases the character of major seizures has been replaced by an atypical one, in which there is no tonic convulsion, but a furor of considerable violence, of irregular body movements, with total or partial loss of consciousness. In other cases major seizures are controlled or replaced with minor ones in which loss of consciousness is sometimes incomplete.

Rawnsley⁴ reports the case of a child subject to convulsive seizures. The attacks increased in number and severity until as many as three a day occurred. The child was given luminal, 1 gr. at bedtime, and a weekly purge. In the course of one month there was only an occasional mild attack of a transitory character, with giddiness and slight momentary spasms of the arms, but no loss of consciousness. A month later she had occasional attacks of giddiness only.

Galla,⁵ in an analysis of his results with luminal, states that 36 out of a total of 125 cases were either not improved or deteriorated under the use of the drug, while the remainder did better under luminal than under bromide. The cases most beneficially affected by luminal were those with fits occurring at frequent intervals, and the cases least affected were those whose fits occurred in bouts at considerable intervals of time. The doses employed by Galla rarely exceeded 6 grs. a day of the sodium salt. (In regard to dosage and untoward effects, see below.)

In commenting on the difference of results in different types of cases, Galla states that it would appear probable that a class of epileptics exists who are more refractory to bromide treatment than others;

¹ Virginia Medical Monthly, October, 1921.

² Michigan State Medical Society Journal, January, 1922.

³ Loc. cit.

⁴ Journal of the Royal Army Medical Corps, March, 1922.

⁵ British Medical Journal, August 27, 1921.

such a class would obviously show the greatest number of fits when treated by bromides, but at the same time the patients are not less susceptible to luminal than their fellows, and, consequently, it is with these cases that the drug shows its most marked effect.

Voje¹ states that luminal reduces undue excitability of the cortex and subcortical strata of the brain without unpleasant constitutional or mental effects, and is, therefore, a superior remedy to the bromides in the treatment of epilepsy. Furthermore, luminal is helpful in overcoming any kind of mental or nervous excitement, and seems to be superior to other remedies in combating the drug, tobacco and alcohol habit.

In luminal sleep the nerve cells rest and recuperate, and poisons are eliminated. Any kind of delirium or maniacal attacks, therefore, are overcome much quicker while the patient is in this slumber, with few exceptions.

Jackson and Fell,² in a report of their experiences with luminal, conclude as follows:

1. That luminal in doses of 1 and $1\frac{1}{2}$ grs. daily reduces the convulsion curve.

2. After a period of time the drug loses its effect and there is a secondary elevation of the convulsion curve.

3. Increased doses reduce again the convulsion curve, but there is a secondary elevation on increased doses, and a distinct elevation on the complete withdrawal of the drug. This is no doubt due to increased tolerance to drug and the lack of a curative effect.

4. In 2 of the cases, after withdrawal of the drug, seizures were severe; patients developed status epilepticus and died.

5. Luminal reduces the convulsion curve, but will not completely eliminate the convulsions.

6. Prolonged use of luminal is not free from danger, and withdrawal of the drug should be carried out with greatest care and precaution.

7. The degree of postepileptic confusion and furor was lessened in 2 cases.

8. Luminal offers temporary relief, but the value of its treatment in the custodial epileptic is doubtful, as established tolerance necessitates higher dosage, the continued use and withdrawal of same being associated with serious phenomena.

Dercum³ takes exception to the last conclusion. He states that in asylums we have to do with cases of epilepsy so far advanced in their degeneration that mental symptoms have led to institutional restraint, and also with other mental diseases in which epileptiform attacks are merely symptomatic of an underlying mental disease.

In Dercum's opinion no remedy has proved of so much value as luminal in the ordinary so-called essential form of epilepsy, as met with in general practice. Furthermore, it is apparently harmless and needs but one dose daily, namely, 1 gr. or $1\frac{1}{2}$ grs. at bedtime.

¹ Chicago Medical Recorder, February, 1922.

² Therapeutic Gazette, December, 1921.

³ Ibid.

The seizures are inhibited for long periods of time and in some cases altogether, no recurrences being noted. At the same time there is a marked improvement in the patient's general health. Dercum states that what the results of the administration of luminal in large doses would be, especially in persons presenting serious degenerative mental disease, opens an entirely different problem. In his opinion a sharp distinction should be made in the application of luminal in these two groups of cases.

The drug has now been employed sufficiently long to obtain some information as to its *untoward effects*. Galla¹ states that of the 125 patients treated by him there were 12 who complained of giddiness and drowsiness. Five of these patients showed a definite disturbance of the gait, reeling slightly as if under the influence of alcohol. By diminishing the dose of the luminal, he was able to secure eventual toleration in all but 4 of the 12 patients who complained so persistently of the giddiness that the luminal treatment was suspended. Urticarial rashes appeared in 2 cases at the onset of treatment, but disappeared when it had been continued for a few days. There was no evidence of a tendency to habit formation.

Phillips, in reporting a case of luminal (phenobarbital) poisoning, has collected a number of others from the literature. From these observations he draws the following conclusions:

1. In view of the severe skin rashes, gastro-intestinal symptoms and nephritis that may develop as the result of the use of phenobarbital, this drug should be administered with great care.

2. Since there is little difference between the therapeutic and fatal dose, phenobarbital should not be prescribed in single doses of more than $1\frac{1}{2}$ grs. (0.1 gm.), and not more than 3 grs. (0.2 gm.) should be taken in twenty-four hours.

3. A patient under phenobarbital treatment should be instructed that, on the first appearance of a skin rash or of any untoward symptoms, he should stop the drug and report to his physician at once.

4. The urine of a patient under phenobarbital treatment should be examined once or twice a week.

5. Phenobarbital should not be dispensed by druggists except on the prescription of a physician.

McNerthney² reports the case of a woman who took a massive dose of luminal, amounting to 75 grs. According to bystanders, she became drowsy, with continuous yawning in ten minutes. When seen by McNerthney, three-quarters of an hour later, she was in a deep, quiet sleep, the pupils being slightly contracted and sluggish to light. She was given apomorphine without producing vomiting and her stomach washed out twice. She remained in a profound sleep for eight hours and then gradually assumed her usual state of mind. During the time she was asleep the respiratory and pulse-rate seemed but slightly changed from normal.

Curiously enough, eight months after taking this massive dose she

¹ Loc. cit.

² Therapeutic Gazette, February, 1922.

has been free from epileptic seizures, although previously she would have only an occasional period of from four to six days without one.

Magnesium Sulphate. Two cases of *poisoning* from the use of magnesium sulphate are reported by Anderson.¹ One of the children was suffering from Uncinariasis, and the other from *Tenia nana*. Both were given 2 ounces of a saturated solution of magnesium sulphate, following which each child had four or five large watery stools. The following morning breakfast was omitted and at 6, 8 and 10 A.M., 1 child was given 8 grs. of the oleoresin of male fern and the other 8 grs. of thymol. At noon both were given 1½ ounces of a saturated solution of magnesium sulphate. No purging followed this second dose. Ten hours later both children were profoundly collapsed. They complained of intense abdominal pain, of being hot, were nauseated and vomited coffee-ground vomitus almost continuously, so that no food was retained for forty-eight hours. Both children would sink into a comatose state, the respiration being scarcely perceptible and very slow and deep. At all times, however, they could be aroused, tell how they felt and their mentalities were clear. Their extremities were cold the pulse could hardly be felt at the wrist and the heart sounds were rapid and weak. There was no jaundice or convulsions.

There was slight general rigidity of the abdomen. For about twenty hours there was suppression of both urine and feces.

Treatment consisted of high colon irrigations with physiologic sodium chloride solution and 5 per cent glucose solution given per rectum. This was followed by improvement. The children were able to retain coffee, the pulse became stronger, the respiratory rate returned to normal and the stuporous condition slowly disappeared. Within four or five days the children had returned to their normal condition.

Mercury. The effect of organic mercury compounds on tubercle bacilli has been studied by DeWitt.² She found that the power of phenol to inhibit the growth of the tubercle bacillus was greatly increased by the substitution of a mercury salt in place of one of the hydrogens. She also found that, while saligenin or phenol carbinol has the same inhibitory power as phenol, the mercury derivatives of this have a greatly increased efficiency, varying somewhat with the percentage of mercury. In the anilin compounds, also, the substitution of a mercury group greatly increases the efficiency.

The use of mercury by mouth in the treatment of *syphilis* was once the almost universal method. Milian³ points out this method is again being more generally employed. In order to overcome the intolerance which sometimes accompanies this method, Milian recommends mixing 0.75 gm. of bismuth subnitrate with 0.01 gm. of calomel (for one of sixty powders). He states that this combination is an excellent means of warding off signs of intolerance. The bismuth seems to prevent diarrhea, anorexia, stomach derangements and even stomatitis, when mercury is given by mouth. He advises giving the

¹ Georgia Medical Association Journal, December, 1921.

² Journal of Infectious Diseases, April, 1922.

³ Bulletins de la Société Médicale des Hôpitaux, November 11, 1921.

mercury in this way, even if only to supplement other routes. The bismuth must be continued as long as the mercury is being given. Milian believes that this combination has a spirocheticidal action of its own.

In an article on the clean inunction treatment of syphilis with mercury, Cole, Gericke and Sollmann¹ state that the inunction method is not employed by many for several reasons: (1) Because it is dirty and disagreeable; (2) it is apt to lead to discovery; and (3) when the preparation remains on the skin for any length of time it is apt to set up a folliculitis. They treated 44 patients in the following way: Four grams of the official unguentum hydrargyri (U. S. P.) were rubbed in for thirty minutes. At the end of this time all mercury remaining was thoroughly removed from the skin by the free use of benzine and cotton. With these patients a different spot was used each night for at least six nights, in order to prevent chances of irritation of the skin and thus forestall the criticism that mercury was being absorbed through the irritated skin. As a result of this preliminary study, they believe that in treating syphilis by the inunction method it is probable that the only mercury absorbed is that part which is rubbed into the hair follicles and entrances of the sebaceous and sweat glands. Hence, all superfluous ointment remaining on the skin may be cleansed off immediately after the inunction without lessening the mercurial effect.

As a result of this experience with 44 cases, they believe that in the future mercurial inunctions need not be discarded because of the unpleasant consideration in regard to their use, namely, uncleanness, the fear of discovery and causing a folliculitis. They, furthermore, recommend this technic in the treatment of syphilis as a distinct advance in the therapy of the disease.

The same authors² have also made a study of the effect of the inhalation of mercury fumes in the treatment of syphilis. Their results indicate that the administration of mercury compounds by inhalation has no advantage over oral administration. On the contrary, it has the serious disadvantage of indefinite dosage, and the consequent difficulty of steering between inefficiency and danger, and of special danger of respiratory irritation.

Almkvist³ has reported 26 cases of *mercurial tonsillitis*. The tonsils were involved alone in 15 cases; in 9 others it was accompanied with gingivitis or stomatitis; and in 2 others there was salivation. He regards the condition as merely the casual localization in the throat of an ordinary *mercurial stomatitis*, but it is often mistaken for Vincent's angina. Fever was present in but 2 of the cases. The angina persisted for from one to twenty-two days after the beginning of treatment. Both tonsils were involved in 9 instances.

The angina developed as early as after the second injection of mercury in some cases; in others, not until up to forty-eight days after the last injection.

¹ Journal of the American Medical Association, December 24, 1921.

² Archives of Dermatology and Syphilology, January, 1922.

³ Hygiea, October 16, 1921; Abstract, Journal of the American Medical Association.

Cases of poisoning with mercury continue to be reported, but not to the extent of a few years ago. That they should occur at all is almost inexplicable in view of the fact that the accident is so common and, as a rule, is so freely commented upon in the lay press, owing to the social prominence of many of the victims. The danger of keeping mercuric tablets in a household is, or should be, generally appreciated, so that taking these tablets by mistake for aspirin or similar popular remedies should be impossible.

In past years there have been reports of systemic poisoning as the result of the introduction of bichloride tablets or strong mercury solutions into the vagina. All of these cases have been the result of using the drug without a doctor's advice and, as a rule, for the prevention of conception.

Sexton¹ reports the case of a woman, who used a strong mercury solution (mercuric chloride) as a vaginal douche. Within an hour she was seized with violent abdominal pain and vomited. A profuse and painful diarrhea began about two hours later, with the passage of much blood-stained fluid.

The urine diminished within five or six hours and by fourteen hours was completely suppressed.

The patient died on the sixth day. The autopsy revealed a general peritonitis of moderate degree. In the region of the hepatic flexure of the colon the intestine, for a distance of fourteen inches, was markedly inflamed and infiltrated.

The kidneys were uniformly congested, and the substance, on section, presented a cooked appearance. The pyramids were extremely prominent and the capsules stripped readily. Sexton attributes the sudden development of symptoms to the fact that the solution probably passed into the uterus, and thence through the tubes into the peritoneal cavity where it was rapidly absorbed.

A case of mercury poisoning with recovery is reported by Ellsworth.² The patient, a woman, took, with suicidal intent, 120 cc of a solution of bichloride of mercury containing 4 gms. of the salt. The patient vomited freely shortly after taking the poison, and, when seen shortly after by a physician, the stomach was washed out with four quarts of warm water and than half a quart of milk and the whites of two eggs were poured into the stomach. The latter was vomited almost immediately.

The quantity of urine from the sixteenth day was never less than 1500 cc and increased with the fluid intake. The albumin became less and none was found after the twentieth day. No casts were found after the twenty-first day.

In view of the fact that the patient vomited almost at once after swallowing the solution, it is probable that only a small portion of the mercury could have remained or been absorbed. Another case of poisoning with recovery is reported by Funk and Weiss.³

¹ Journal of the American Medical Association, May 13, 1922.

² Pennsylvania Medical Journal, June, 1922.

³ Journal of Laboratory and Clinical Medicine, January, 1922.

Certain drugs, notably the silver salts, are prone to produce *discoloration of the skin*. Goeckermann¹ has observed 2 patients with localized pigmentation of the skin, resulting apparently from mercurial salts in a face cream. In both cases the discoloration on the face and neck presented the appearance of skin that was not sufficiently washed. Both patients were advised to wash the discolored parts of the skin with a 2 per cent aqueous solution of acetic acid twice daily. In 1 case the discoloration was appreciably lighter at the end of three months. It was then decided to use a 1 per cent aqueous solution of potassium cyanide, because of its well-known ability to form water-soluble salts with some of the heavy metals, including mercury. Three months later the patient stated that the discoloration was constantly growing lighter but had not yet entirely disappeared. The second case also responded to the acetic acid solution, but disappeared after six weeks' treatment.

Goeckermann points out that the pigmentation is apt to persist, even with proper solvents, as the deposit is actually within the gland ducts and therefore relatively inaccessible to a solvent.

Another *untoward effect of mercury* is described by Gougerat and Plamoutier.² They describe cases in which a severe dermatitis, edema of the skin and mucous membranes, and diarrhea with hemorrhage followed application of mercury to the scalp, or as a mouth wash, or by subcutaneous injection. In other cases there were severe local reactions to the injections of mercury. They believe these cases offer a prospect of successful desensitization whether the disturbances occur on the first taking of the drug (idiosyncrasy) or the intolerance developing later (anaphylaxis). Certain recent experiences seem to indicate that a small preliminary dose may offer protection.

They also report the case of a man who developed an intense desquamating eruption on resuming mercurial treatment by mouth after seven years' suspension. He had never shown any intolerance previously. The symptoms of the anaphylaxis to mercury developed after a very small amount of mercury had been taken. Pruritus appeared on the third day and the eruption on the fifth day. The tenth day it became intense, but there were none of the usual symptoms of mercurial poisoning. The eruption could be induced and banished at will by giving or withdrawing small doses of mercury by mouth.

Methylene Blue. The use of a saturated solution of methylene blue is advised by Rosenblatt and Stivelman³ in the treatment of tuberculous pyopneumothorax. Three cubic centimeters are injected at a time until sterilization is effected.

Nicotine. This is a very rapidly-acting and fatal poison, being equaled only by hydrocyanic acid. McNally⁴ calls attention to the fact that commercial preparations, containing from 8 to 43 per cent of the alkaloid, are used in very dilute solutions as insecticides. These

¹ Journal of the American Medical Association, August 19, 1922.

² Bulletin de la Société Médicale des Hôpitaux, June 2, 1922.

³ American Review of Tuberculosis, December, 1921.

⁴ Journal of the American Medical Association, July 30, 1921.

solutions are occasionally taken accidentally or with suicidal intent. McNally reports the case of a man who took a liquid containing 42.4 per cent of nicotine, thinking it was whiskey because of the brown color.

He was admitted to the hospital in an unconscious condition, with slow, stertorous breathing and gurgling sound in the throat on each inspiration. The systolic pressure was 110 and the diastolic 74. The pupils were equal and contracted. There was no evidence of a corrosive poison.

The treatment consisted of washing out the stomach with water and tannic acid, and the washing continued until the fluid returned clear. The patient made an uneventful recovery, regaining consciousness shortly after the stomach had been washed out.

McNally attributes his recovery to the early and copious vomiting and the efficient washing out of the stomach, as the amount of the poison he took was enough to have killed several persons.

Nitrites. Ever since the nitrites were introduced by the late Sir Lauder Brunton, for the relief of pain in *angina pectoris*, these salts have been employed quite generally. Many have seen the relief given by the inhalation of the fumes of amyl nitrite or the hypodermic use of nitroglycerine, with or without morphine. Attacks also are aborted apparently by the oral administration of nitroglycerine or sodium nitrite. Brunton employed them because he had noted that they relaxed arterial spasm. His conception of how they did good in cases of angina pectoris was that in such patients there was a spasm of the coronary bloodvessels, and as a result the heart muscle suffered from a material diminution in its blood supply. The exact cause of the pain in angina is not known. Various hypotheses have been advanced but none have obtained general acceptance. Fred M. Smith¹ carried out some experiments on dogs to throw light on the action of the nitrite on the coronary vessels. The action of nitroglycerine on the collateral circulation between distal branches of the left coronary artery was studied in 15 dogs. In 5 the area of cyanosis that appeared distal to the point of closure of one of these vessels definitely faded, following the administration of nitroglycerine. In 6 the results were questionable, and, in 4, they were apparently negative. The observations in the former 5 indicated that there was a communication with the adjacent vessels which was dilated by the nitroglycerine. In the latter 10 it was concluded that very little collateral circulation existed.

In 14 dogs the action of sodium nitrite was determined. In 6 there was a definite increase in the outflow. In 3 the rate remained about the same, and in 4 it was decreased.

It would appear that this study does not throw much light upon the question.

Hare,² in commenting upon the experiments, states that whatever the explanation may be, the fact remains that these drugs give us the best results at the bedside, and it remains for experimental investigation

¹ Archives of Internal Medicine, December, 1921.

² Therapeutic Gazette, 1922, p. 315.

to reveal how they act if Brunton's original explanation is, as some think, inadequate or incorrect.

Orthoform. Rosenbloom¹ states that it is not generally known that the external application of orthoform can lead to an alarming generalized dermatitis. He reports a case in which the application of a 5 per cent orthoform ointment caused this condition. The scalp and face were involved. The dermatitis was accompanied by marked edema of the tissues, especially of the face, where it resembled that occurring in glomerular nephritis. The condition was produced a second time in the same patient. Rosenbloom cites a similar occurrence reported by Bastedo, the ointment being applied to the hand. In this case a recurrence was also produced by a second application.

Rosenbloom raises the query as to whether anesthesin and profesin, nearly related to orthoform, are capable also of causing a dermatitis in certain cases.

Oxygen. Until the introduction of the so-called open-air treatment of pneumonia, oxygen was almost universally used in the treatment of that disease; particularly in those cases with cyanosis and difficulty in breathing. With the popularization of fresh air, the oxygen tank practically disappeared. During the last few years the therapeutic uses of oxygen have received a good deal of attention. This may be ascribed, in great measure, to the remarkably good results obtained in cases of *gas poisoning* from the inhalation of oxygen.

A marked reduction in the oxygen intake results in imperfect aëration of the arterial blood. This is well shown in mountain climbing, ballooning and aviation. The physiologic effects of imperfect oxygenation of the blood are, periodic breathing, nausea, headache and impaired circulation. In addition, there may be serious progressive damage to the central nervous system, heart and other organs. These latter changes are said to be entirely due to lack of oxygen.

An experiment of Barcroft's is cited by Barach. He lived for five days in a chamber in which the pressure of oxygen was lowered until his oxygen saturation at rest was 88 per cent (normal, 95 per cent). He then experienced the effects of mild anoxemia. His pulse rose from 56 to 86, he was nauseated, racked with headache and suffered from visual disturbances and vertigo. He became faint on exertion.

As the arterial saturation of patients ill with pneumonia frequently falls much lower than that experienced by Barcroft, it demonstrates that the ill-effects of anoxemia must be an actual accompaniment of clinical disease.

Summarizing, it might be said that the disturbance of the gastrointestinal system is manifested by nausea, vomiting and diarrhea; the respiratory system by periodic respiration, and later by rapid, shallow respiration; the circulatory system by a constant and progressive increase in the pulse-rate and in the end by a fall in diastolic pressure and cardiac failure; the central nervous system by headache, visual disturbances, irrational states and delirium and, finally, coma and death.

¹ Journal of the American Medical Association, January 28, 1922.

Barach¹ states that oxygen failed in the past as a therapeutic agent largely because of the absence of an ideal method of administering it. There is no commonly available method that can supply to the patient an effective concentration of oxygen without in some degree interfering with his comfort. The apparatus most widely used in this country and in England, the tube and funnel, adds less than 2 per cent oxygen to the inspired air, whereas from 40 to 70 per cent is needed.

The effects of oxygen in the treatment of *pneumonia* have been studied by Barach and Woodwell.² These observations were conducted on 11 patients with lobar pneumonia, each of whom had an arterial anoxemia at some stage of the disease, and 4 patients with *bronchopneumonia*, 2 of whom had an arterial anoxemia.

Barach³ states that the disease in which acute anoxemia occurs with the greatest frequency and with the greatest severity is pneumonia, and it is here, therefore, that oxygen therapy is most urgently indicated. The use of oxygen can be expected to remove, or diminish, the ill-effects of acute anoxemia, and in that way to improve the patient's chances of recovery, and at times directly avert death. The clinical guide to its use is the presence of *cyanosis*. Barach states that in pneumonia cyanosis has been said to run parallel to the degree of arterial anoxemia. It is to be borne in mind, however, that this applies only to patients without anemia.

The duration and frequency of administration are problems dependent on the individual patient and the resources at hand. It would seem theoretically desirable to keep the patient free from cyanosis as many hours of the twenty-four as possible. In very severe cases it may be necessary to give oxygen continuously. In less severe cases benefit may be derived from oxygen administered at frequently repeated intervals. The signs which should be borne in mind, and which usually reflect improvement, are: (1) The degree of cyanosis; (2) the pulse-rate; and (3) the mental condition of the patient.

The degree of cyanosis is, with some exception, the most trustworthy clinical guide in the oxygen treatment of pneumonia. If the cyanosis fails to clear up the prognosis, in Barach's experience, is distinctly worse. On the other hand, the prognosis is much improved when the cyanosis clears up under the use of oxygen.

Carefully noting the pulse-rate is also important. Even in normal persons the inhalation of oxygen causes some slowing of the pulse-rate. In cases of pneumonia which react favorably to oxygen the pulse-rate is decreased to a much greater extent. Barach states that the reason for this presumably is that anoxemia is itself the cause of rapid heart action. On the other hand, the respiratory rate is usually unaffected; only occasionally is it slowed, subjective dyspnea does not seem to be due to oxygen want, nor is it usually relieved by the inhalation of oxygen.

¹ Journal of the American Medical Association, August 26, 1922.

² Archives of Internal Medicine, October, 1921; Barach: Loc. cit.

³ Loc. cit.

In addition to these effects, the mental condition becomes more alert and clearer.

In the cases studied by Barach and Woodwell¹ the most consistent changes in the clinical condition were the clearing of the cyanosis and slowing of the pulse-rate. The respiratory rate was slowed sometimes, but the dyspnea was not usually relieved. The mental condition was frequently improved.

Their experience indicated that oxygen inhalation for a half hour was sufficient in the mild or moderate cases of anoxemia to elevate the arterial saturation and cause clinical improvement. In the severe cases one to two hours was necessary. The effect of a single administration was, in the main, temporary. The effect of repeated and prolonged administration produced persistent beneficial change in the oxygen saturation of the blood, the pulse, breathing, color, comfort and mental condition of the patient.

In *cardiac insufficiency* the arterial saturation varies from 95 to 75 per cent (normal, 95 per cent). The effects of oxygen in 7 cases of cardiac insufficiency were studied by Barach and Woodwell.² Arterial anoxemia was present in all, and stagnant or venous anoxemia in all except 1. The arterial anoxemia of acute bronchitis and emphysema, occurring in cardiac insufficiency, was fully relieved by oxygen inhalation and the venous saturation was correspondingly elevated. Also, in cases complicated by widespread pulmonary edema the relief of arterial anoxemia was accomplished in from forty-five minutes to two hours.

As a result of their observations in these severe cases, Barach and Woodwell state that the relief of the cyanosis and the slowing of the pulse were the outstanding objective changes. The blood-pressure, vital capacity, arterial and venous carbon dioxide content, urinary excretion and rate of respiration showed no definite change from short periods of oxygen inhalation. The electrocardiogram showed consistent changes in 2 cases of right bundle branch block, no change in one uncomplicated case of auricular fibrillation. Subjectively, the patients usually said they felt more comfortable or that their breathing was better, but they were rarely enthusiastic.

In a third paper Barach and Woodwell³ report 2 cases of *lethargic encephalitis*, in whom there was an extreme type of shallow breathing attended with deep cyanosis and coma. The arterial blood was markedly deficient in oxygen and contained an excess of carbon dioxide.

Inhalation of oxygen greatly relieved the arterial anoxemia, but was without effect on the steady accumulation of carbon dioxide. The circulation was strikingly improved in the beginning as a result of the relief of the anoxemia, but, later, progressive cardiac failure occurred, apparently related to the carbon dioxide retention. They believe it is evident that shallow respiration, if extreme, interferes not only with oxygen absorption but with carbon-dioxide elimination. It also seems probable that a terminal involvement of the respiratory center in lethargic encephalitis is at times the cause of death.

¹ Loc. cit.

² Ibid.

³ Ibid.

Barach¹ states that the great problem, at present, in oxygen therapy is an efficient method of administration. As mentioned above, only about 2 per cent of oxygen is inhaled with the method commonly employed in this country and England. A mixture of air which contains between 40 and 60 per cent of oxygen seems desirable. Less than 40 per cent may not be effective and more than 70 per cent may be harmful. Barach states that an oxygen chamber is the ideal thing, but it is impracticable for widespread use. The available methods at present in use are face masks, an insufflation apparatus and the oxygen tent of Leonard Hill. A method recently devised by Yandell Henderson is the best available, in Barach's opinion. He gives a full description of its use in the *Archives of Internal Medicine* for October, 1921. He states that the apparatus can be secured from Mr. Warren E. Collins, 584 Huntington Avenue, Boston, Mass.

Ouabain. Ribierre² recommends the use of ouabain in cases of *cardiac insufficiency*, due to lack of tone in the myocardium, especially the left ventricle, even when there is marked albuminuria and insufficiency of the kidneys. The drug should be given cautiously, with the patient in bed and on a salt-free diet. He cautions against using the ouabain until at least eight days after digitalis has been given. On the other hand, digitalis can follow the ouabain, with favorable results, especially from the standpoint of diuresis.

Phenol (Carbolic Acid). The treatment of *erysipelas* by means of the local application of phenol is recommended by Porter.³ He applies 95 per cent pure phenol on a cotton-wool swab over the involved area and for half an inch beyond. It is left on until the purplish area of the inflamed skin is replaced by a complete whitening of the skin. This must not be allowed to proceed to complete blanching, and, when large areas are involved, only a portion must be painted at one time.

The second step consists in going over the blanched area with swabs saturated with methylated spirit. The alcohol must be laid on until the whitened area again becomes pink. Afterward, other areas should be treated in the same way until the whole operation is completed in one sitting. The later treatment consists in the application of a dressing moistened with simple saline solution or mercuric chloride, 1 to 20,000.

Phenolphthalein. *Skin eruptions following the use of phenolphthalein* as a laxative are reported by Wise and Abramowitz.⁴ In 5 cases observed by them there was a peculiar polychromatic eruption on the skin, with bullous, vesicular and eroded lesions of the mucosæ and genitals. The cutaneous lesions leave pigmented areas which persist for months and even years. They flare up after taking the drug and usually affect the same sites as in preceding attacks. The eruption exhibits many points of similarity to those resulting from antipyrine and arsphenamine.

¹ Loc. cit.

² Bulletins de la Société Médicale des Hôpitaux, April 28, 1922.

³ Indian Medical Gazette, June, 1921.

⁴ Archives of Dermatology and Syphilology, March, 1922.

Corson and Sidlick¹ report a case in which the prolonged use of phenolphthalein caused an *urticarial rash*. In both articles quoted there are numerous references to similar cases in which phenolphthalein used as a laxative caused skin changes. They also call attention to the fact that the text-books make no mention of such an occurrence.

Phosphorus. The present enthusiasm for dietary fads and the alleged necessity of seeing that one's food contains the necessary vitamins and salts has caused some to forget that the diet to which man has long been accustomed contains all the needed ingredients. Some years ago a lay dietitian took me to task because I did not know how much phosphorus a certain group of children were getting. It is, therefore, comforting to note that Blatherwick and Long² present data which indicate that the vegetables in common use are capable of furnishing sufficient phosphorus and calcium to meet the maintenance needs of man.

In the treatment of *phosphorus poisoning*, Atkinson³ states that liquid petrolatum given within an hour after taking the poison furnishes complete protection against the onset of harmful symptoms. It is physiologically inert and acts entirely by reason of its physical properties. He suggests that inasmuch as it delays absorption from the intestines, it might be used to advantage in all poisons.

Pituitary Extract. Physical defects due to abnormal anterior pituitary secretion are divided by Scott and Broderick⁴ into those of preadolescence and postadolescence. The former are chiefly defects of growth and development, and the latter chiefly of function.

They state that while the thyroid tells more on the brain and nervous development, the pituitary effects osseous and sexual, although no fast line can be drawn between the two influences. Scott and Broderick point out that very often the slow developing, dull adenoid type improves rapidly under the use of thyroid as far as intellect is concerned, but the body and limb growth falters. In such cases a combination of thyroid and pituitary does excellently. In girls, especially, the intellectual life may be active and even brilliant, but the uterine and ovarian development are almost standing still, unobserved and untreated. Girls of this type usually grow up sex failures. Never advancing beyond rudimentary growth of uterus and ovaries, they swell the ranks of the disappointed, the sterile and the nervous invalids.

They often begin to menstruate at thirteen or fourteen years, and go on for a year perhaps; then comes irregularity or complete cessation. Scott and Broderick believe that this state of things, when not due to manifest anemia, points almost conclusively to hypopituitarism, and can be helped wonderfully by anterior pituitary medication. It should be given in good doses for two or three years, or until healthy menstruation is well established. Under its influence the pelvic organs develop as Nature demands.

¹ Journal of the American Medical Association, March 25, 1922.

² Journal of the Biological Chemistry, May, 1922.

³ Journal of Laboratory and Clinical Medicine, December, 1921.

⁴ Practitioner, October, 1921.

They also point out that children of both sexes, who have *enuresis*, often get well under the use of thyroid, but there are failures too, and in these the combination of the two gland extracts will often succeed. Cases especially demanding pituitary are those in which there are subnormal skeletal growth and osseous development.

Jacoby¹ considers that the chief factor in the production of female sterility is a dysfunction of the ovary. Careful study will also show that in addition there is usually a deficiency of the pituitary, thyroid or suprarenals. Dysfunction of one or the other of several of these glands produces conditions which make it impossible for pregnancy to successfully occur. Jacoby points out the uselessness of dilating, curetting or otherwise operating on the great majority of these patients. In the absence of any obvious gross pathologic conditions, a careful study of the endocrine system should be made in order to determine, if possible, the gland extract needed.

One of the most successful uses to which pituitary extract has been put is in the treatment of *diabetes insipidus*. The only objection to this treatment has been the inconvenience of using the extract hypodermically. Blumgart² reports the use of *pituitrin* intranasally. In a case of diabetes insipidus, pituitrin applied intranasally checked both the polyuria and polydipsia. In 3 additional cases the intranasal use of pituitrin was found as satisfactory as hypodermic injections in reducing the fluid intake and urinary output to an approximately normal level.

Rees and Olmstead³ studied the possibility of finding a satisfactory method of administering pituitary by mouth. They considered reduced expenses and the increased inconvenience as the principal factors. The details of a case of diabetes insipidus are given, in which various types of treatment were tried. They found that by giving desiccated posterior-lobe substances in salol-coated capsules the polyuria and polydipsia were as effectively controlled as with hypodermic injections of pituitary extract.

In another study on the oral administration of pituitary extract, Hamill⁴ found that animal experiments prove that administration by mouth causes the characteristic internal contractions. Absorption takes place from the stomach and is more rapid when the stomach is full and actively digesting. Large doses produce colicky contractions of the intestine and vomiting. This experimental observation harmonizes closely with clinical evidence. Hamill, therefore, advises, in view of the rapid absorption from the stomach and the fact that the intestinal juices rapidly destroy the active principle, it would appear preferable that pituitary extract should be administered in solution and after meals.

PITUITRIN IN OBSTETRICS. Shortly after pituitrin was introduced into obstetrical practice, not a few fatalities were reported from its

¹ Medical Record, February 11, 1922.

² Archives of Internal Medicine, April, 1922.

³ Endocrinology, March, 1922.

⁴ Proceedings of the Royal Society of Medicine, June, 1921.

use. This occasionally resulted in rupture of the uterus. Fortunately, reports of this accident are becoming rarer. That the careless use of pituitrin still occasionally prevails is shown by the report of a case by M. A. Dorland.¹ He was called to see a woman who had been confined by a midwife. The patient, an octipara, had been in labor about eleven hours and was progressing normally when the midwife, becoming fatigued, administered hypodermically 0.5 cc of pituitrin and followed this in an hour by a second dose. In about ten minutes after the second injection the patient experienced a very painful contraction, during which the uterus evidently ruptured. The patient was removed to a hospital and the abdomen opened. The child, weighing 11 pounds, was dead. The uterus was found to be ruptured throughout the attachment of the broad ligament nearly to the fundus. The woman died forty-eight hours later.

The contraindications to the use of pituitrin in obstetrics have frequently been stated in previous issues of *PROGRESSIVE MEDICINE*, but they bear repeating. Mendenhall² epitomizes them as follows:

1. Undilated cervix.
2. Disproportion between passenger and passage.
3. Abnormal presentation or position.
4. Presence of obstructing tumors.
5. Scar from previous Cæsarean or myomectomy.
6. Heart disease of mother.
7. Eclampsia.
8. Atheroma.
9. Threatened asphyxia of child in utero.
10. Contractions which are already strong.

If this latter point alone were constantly borne in mind there would be far less use of pituitrin and consequently very much less damage done. So long as the patient is having fairly strong and frequent pains there can be no excuse for giving her a drug that will increase them in frequency or strength when attended with such great dangers.

In regard to pains which are weak and are declining, in addition to the above, Mendenhall states that we may be said to have indications justifying the cautious use of small doses of pituitrin (2 to 3 minims), remembering that episiotomy or low forceps, or both, are usually better obstetrics.

In the matter of dosage, Johnson³ states that when he first began the use of pituitrin in obstetrics he gave it in doses of 1 cc, and only to multiparæ who were nearing the end of labor. He soon found, however, that the resulting expulsive efforts were unnecessarily violent. He then adopted the plan of not giving more than 2 minims as an initial dose, and in some cases 1 minim or even 0.5 minim. He now employs pituitrin in these doses in primiparæ as well as multiparæ, and in the first, second or third stage of labor, and for the induction of labor. If it is administered with a tuberculin syringe, which enables one to accurately measure the dose, no harm will result.

¹ Journal of the American Medical Association, January 21, 1922.

² Indianapolis Medical Journal, August, 1921.

³ Medical Record, March 4, 1922.

If 1 minim does not produce a reaction in fifteen minutes a little larger dose may be given, and, if the contractions become too strong or too frequent, they can be modified promptly by a hypodermic injection of heroin or a few whiffs of ether.

Johnson feels that it is wrong to withhold this aid to labor because there have been accidents due to carelessness or ignorance.

Most obstetricians hold the view, however, that pituitrin, in the absence of certain definite contraindications, should be used in the third stage of labor only. From his own experience, Hefferman¹ believes that pituitrin administered at the beginning of the third stage of labor is effective in aiding a prompt and complete detachment and expulsion of the placenta and membranes.

Tetanus uteri, with incarceration of the placenta, does not occur from the careful use of pituitrin in the third stage of labor. Furthermore, pituitrin tends to prevent relaxation of the uterus and post-partum hemorrhage during and after the third stage of labor. Manual removal of an adherent placenta should not be attempted until at least three doses of pituitrin have failed to produce detachment.

Brodhead and Langrock² believe that the only drawback to the use of pituitary extract, at the beginning of the third stage of labor, is the possible existence of irregular or hour-glass contraction of the uterus. Inasmuch as this complication occurs independently of the use of pituitary extract, further investigation will be necessary to determine whether this complication is directly attributable to the method or not.

Ryder³ has studied 100 cases in which 1 cc of pituitary extract was given at the beginning of the third stage of labor and 100 cases in which it was not used. In none of the 100 cases in which the pituitary extract was employed was there any untoward effect.

The extract tends to cause spontaneous expulsion of the placenta, lessens the amount of blood lost and makes the guarding of the fundus during the third stage easier, as little stimulation of the fundus is necessary to keep it contracted. It does not, however, do away with the necessity of watching or holding the fundus. Not only must the fundus be well contracted, but it must be kept from riding high, otherwise unobserved bleeding may occur into the membranes already partly expelled into the vagina.

Pouliot⁴ refers to the use of pituitary extract in the posterior varieties of vertex presentation. (Abnormal presentations, as a rule, contraindicate the use of pituitrin.) In these posterior presentations, Pouliot states that expulsion is always slower than with the anterior varieties. With multiparæ, labor usually lasts four or five hours longer, and with primiparæ it is considerably longer than this. Pouliot states that the rule that pituitary extract should not be given until the period of expulsion, waiting until the os has become dilated, does not apply in

¹ Boston Medical and Surgical Journal, October 13, 1921.

² American Journal of Obstetrics and Gynecology, February, 1922.

³ Ibid., July, 1921.

⁴ Revue Franç. de Gynécologie et d'Obstét., March, 1922.

these cases. His belief is that the indication is not the diameter of the os, but whether the inferior segment is becoming thinner and more supple. He describes 9 cases of O. I. P. presentation, illustrating how the pituitary almost instantly stimulates the deficient contractions. In multiparæ delivery proceeded rapidly and easily. In primiparæ the results were less constant and less immediate, but still they appreciably shortened the labor and usually rendered forceps unnecessary.

Pouliot states that in 100 deliveries under pituitary treatment, only 1 infant was affected and that but very slightly. He employs 1 cc and, if this proves effectual, he repeats it after the effect is quite exhausted, even in an hour. He emphatically warns against a second injection if the first has failed, and, furthermore, he emphasizes the fact that only the obstetrician should administer the pituitary.

Norgate¹ has used pituitrin in 36 cases of *inoperable cancer*. He was led to this use of the pituitrin from the observation that pituitary extract (posterior infundibular) was effective in controlling the intestinal bleeding.

He first tried it in a case of sudden and severe hemorrhage from an extensive epithelioma of the tongue. One cubic centimeter was injected into the tongue muscle. All bleeding stopped at once and there was no repetition. Weekly injections into the tongue for three months resulted in marked improvement. The patient put on weight and the cachexia disappeared. Later, however, he died from a metastatic growth in the liver.

Norgate sometimes gives the injection directly into the cancer; in other cases, placing it as near the growth as seems practicable. He noted that in twenty seconds the patients experience severe pain in the back or abdomen, and a sensation of squeezing the growth, followed by an anemia, which may be alarming, and a weak pulse. The condition may be relieved by the use of brandy, but is preferably to be untreated.

According to Norgate, the use of pituitrin in these cases nearly always brings about an increase in appetite and strength and weight. Norgate states there also seemed to be a delay in the onset of secondary gland involvement and a tendency toward abortion of the growth; nor was there observed secondary deposits in other parts of the body. The use of pituitrin is especially commended as a means of controlling hemorrhage.

The effect of extract of the posterior lobe of the pituitary on *basal metabolism* in normal individuals and in those with endocrine disturbances has been studied by McKinley.² He draws the following conclusions:

1. Normal persons responded quite constantly with increased basal metabolism following the subcutaneous injection of pituitary extract.

2. In a small series of cases with hypothyroidism the basal metabolism was diminished rather than increased, which suggests that pituitary extract is effective in accelerating heat production only in the presence of a normally functioning thyroid gland.

¹ British Journal of Surgery, April, 1922.

² Archives of Internal Medicine, December, 1921.

3. In four cases with subnormal basal metabolism, in which clinical evidence of myxedema was lacking and preponderance of influence of endocrine glands other than thyroid was suggested, the positive response to pituitary extract was present.

4. The increased acceleration of basal metabolism in a group of normal individuals following the subcutaneous injection of pituitary extract one week after an injection of thyroxin is interpreted as suggesting a synergic action between thyroxin and pituitary extract.

Potassium Nitrate. While admitting its use is somewhat empirical, Pennington¹ recommends the use of potassium nitrate in the treatment of *osteomyelitis*. The salt is mixed with oats (10 to 60 grs. to the ounce of oats) and sufficient hot water added to reduce it to a poultice-like mass. This is then spread over the affected area to the thickness of about three-sixteenths of an inch, then with oiled silk, paraffine paper or a rubber dam, and over this a bandage. The poultice is applied well beyond the area involved.

A case of *poisoning* from the internal use of a mixture of potassium nitrate and sulphur is reported by Windmueller.² The patient was advised by a friend to take equal parts of sulphur and saltpeter in teaspoonful doses four times a day. He followed this treatment for twenty-six days, taking approximately 10 gms. of potassium nitrate. From a man who was apparently healthy, he appeared with sunken eyes, marked loss of weight and very nervous. He complained of intense muscular pain, which was aggravated by motion or touch, similar to that encountered in trichinosis.

The blood findings showed a severe grade of anemia; hemoglobin, 50 per cent; red cells, 290,000; leukocytes, 8500. There were a few poikilocytes.

The urine was reduced to 20 ounces daily, and contained albumin, a few hyaline and waxy casts and a few red blood cells. The man died, but no autopsy was obtained.

Windmueller does not believe that the sulphur played any part, as it is frequently employed, even in children, as a laxative. Fairly large doses of potassium nitrate have caused acute poisoning and even death. He, therefore, believes that following the rule that all substances which cause acute poisoning will be followed by chronic poisoning with the successive administration of subtoxic doses probably applies in this case.

Potassium Permanganate. The external application of this antiseptic in the treatment of *smallpox* is reported by Balfour.³ He states that the method was originally introduced by Dreyer, of Cairo, in 1910, but apparently has been forgotten. He quotes Bender, of Breslau, as stating he regards it as superior to every other therapeutic agent in smallpox. The method is as follows: When the patient is admitted to the hospital his whole body is painted over with a freshly prepared saturated solution of permanganate of potassium (5 per cent). On

¹ Medical Record, December 31, 1921.

² Journal of the American Medical Association, September 10, 1921.

³ Indian Medical Gazette, December, 1921.

each successive day the same solution is applied unless the skin is found too sensitive, in which case a weaker solution is employed, one of 1.5 per cent being often suitable.

Dreyer had two objects in view: (1) To color the skin and thereby obtain an effect similar to that which the Finsen red-light treatment is said to produce; and (2) to secure a disinfecting and deodorizing action.

Reports by those who have employed this method seem to indicate that this line of treatment, if employed early, is of much service in lessening the suppurative process and adding to the patient's comfort. It is also said to prevent complications, the formation of bed-sores and the occurrence of general sepsis. Septic fever is thus avoided and the recovery rate improved. Furthermore, as the suppuration is mitigated the pitting of the skin is reduced.

Procaine. The occurrence of *dermatitis* from the use of procaine is reported by R. C. Morris.¹ He states that in a dental clinic, in which nerve-blocking is frequently employed, one operator in every twelve showed, as the result of using a hypodermic syringe that would leak in the barrel, allowing the 2 per cent solution of procaine to come in contact with the fingers, a drying, cracking skin that would exfoliate, leaving the true skin red, hypersensitive and painful.

Protein. Uddgren,² in writing on the use of *intramuscular injections of milk*, states that a large injection prolongs the coagulation time of the blood, while a small injection accelerates it. He states that there is practically no danger of anaphylaxis if a small preliminary injection is made, and there need be no fear of a pronounced reaction if a toxin-free milk is used, but one should be cautious in those with heart disease or those of advanced age. Kidney disease does not seem to be a contraindication, as he has seen albumin disappear from the urine after the use of the protein.

Buschke³ warns that latent *tuberculosis* is apt to flare up if protein therapy is employed. The employment of protein therapy in the treatment of *arthritis* should be resorted to, in Cowie's⁴ opinion, only when all possible foci of infection have been considered. He seldom uses a dose under 500,000,000 (dead typhoid bacilli), and children, as well as adults, have received billion doses. He believes it is perfectly safe to fix the average dose for child and adult at 100,000,000 dead typhoid bacilli, and the maximum at 500,000,000. Reactions are usually sharp and include the unpleasant symptoms of nausea, headache and sometimes vomiting. He has never had an untoward result. The dose may be increased beyond the limits given above in certain individuals and in certain types of cases.

He considers that cardiac decompensation, acute cardiac difficulties and conditions associated with hyperthyroidism should be regarded

¹ Journal of the American Medical Association, October 22, 1921.

² Hygiea, July 16, 1921; Abstract, Journal of the American Medical Association.

³ Medizinische Klinik, June 11, 1922.

⁴ New York State Journal of Medicine, November, 1921.

as contraindications. Cowie states that it is thought that intravenous protein injections increase gastro-intestinal peristalsis; hence the importance of careful consideration before employing them in intestinal hemorrhage to increase blood coagulability.

Although Cowie has had no untoward results, Kross¹ regards the method as being unsafe. He has come to the conclusion that protein treatment has not increased the resistance of animals to mouse typhoid, to general peritoneal sepsis, or to pneumonia, and has not enabled them to overcome infection any better than do the untreated ones. In fact, the treatment apparently reduced the vitality of the animals, as is evidenced by their more rapid destruction.

Furthermore, Kross believes that the danger of death from anaphylactic shock is such as to stamp this method of treatment as actually threatening great potential harm. He states that a number of deaths have occurred shortly after intravenous injections of bacterial substances, and in 1 case death followed the intravenous administration of "rheumatism phylacogen." He feels that the utter lack of experimental evidence, and the recognized clinical danger of the procedure, indicate the need of caution in assuming the therapeutic value of intravenous protein injections in the treatment of infections.

In a study of the nature of the action of non-specific protein in disease, Cowie and Greenthal² found that the protective action of normal horse serum precipitated by alcohol was much less than that of untreated horse serum when injected into guinea-pigs which had received a fatal dose of diphtheria antitoxin. No protective effect against diphtheria toxin was observed with the following proteins: Egg white, milk, guinea-pig serum and rabbit serum. One cubic centimeter of normal horse serum, when injected subcutaneously into a guinea-pig, will protect against a fatal dose of tetanus toxin. Cowie and Greenthal believe the protective action of normal horse serum against soluble diphtheria toxin is due to natural antitoxin in the serum and not to the effect of the non-specific protein injected.

Pulsatilla. The use of this drug in the treatment of certain types of *dysmenorrhea* is recommended by Coley.³ The cases in which he prescribed pulsatilla give a history of this kind: They have pain for the first day or two of each menstrual period. Sometimes it begins a day or so before the period. The flow is usually small.

Coley does not use the drug in cases in which the flow is excessive, lasting six days or more, and attended with the passage of clots, pain continuing through the whole of the period, or nearly so. Most of the patients he has treated have been unmarried. Coley does not pretend to explain the pathology of the condition nor the action of the pulsatilla. Relief may be experienced from the beginning, but if not it is almost certain to eventually succeed in the type of case he describes above. He has never known it to produce any undesirable effects, or indeed

¹ Journal of Medical Research, January-March, 1922.

² Ibid.

³ British Medical Journal, January 7, 1922.

any other effect at all than that for which it was prescribed. He uses the following formula:

R—Tinctura pulsatillæ	5iv
Spiritus chloroformi	5ij
Aquæ chloroformi	q.s. ad. 3vi

M. Sig.—Two teaspoonfuls to be taken as soon as menstrual (or premenstrual) pain begins, and every three hours while pain continues.

Quinine. The intravenous use of alkaloidal quinine in the treatment of *malaria* is recommended by Brahmachari.¹ He states that it possesses very marked antihemolytic properties. The solution is made as follows: Quinine alkaloid, 5 grs.; alcohol, 50 minims; urethane, 3 grs.; calcium chloride, 7.5 grs.; glucose, 300 grs.; physiologic sodium chloride solution, 200 cc; 85 per cent solution of sodium chloride in distilled water. This solution is alkaline in reaction and is well borne by malarial patients. Brahmachari states that this solution given intravenously does not lead to such a profound fall of systolic blood-pressure as is observed in the case of quinine bihydrochloride and circulatory disturbances are less marked. Ten cubic centimeters of this solution (equivalent to $\frac{1}{4}$ gr. of quinine alkaloid) given intravenously into rabbits, weighing 450 to 470 gms., did not produce any ill-effects. This amount will correspond nearly to giving 1200 cc of the solution to a man of average weight.

In another article on the intravenous use of quinine, Brahmachari² asserts that the amount of quinine bihydrochloride injected into a vein at the bend of the elbow should not be more than $\frac{1}{120}$ gr. per second, or $\frac{1}{2}$ gr. per minute. This will mean that 10 grs. will take twenty minutes for completion of the injection. Using a dilution of 1 to 300 means that 10 cc will take one minute for injection, and the total amount given will be 200 cc. Higher amounts of fluid, in a patient whose blood-pressure is low, is likely to produce pulmonary edema, which may prove serious in certain cases of pernicious malaria. A dilution less than 1 to 300 may make it difficult to inject at the rate of $\frac{1}{120}$ gr. of quinine per second. In children the rate of injection should be even slower.

For children under fifteen years of age he suggests that 5 grs., instead of 10 grs., should be injected in twenty minutes.

Maxcy³ warns that the intravenous use of quinine in the treatment of malaria is not without danger, and for this reason should not be employed routinely.

Its proper field of usefulness seems to be upon urgent clinical indications of two sorts: (1) In cases in which prompt absorption by the gastro-intestinal tract, following mouth administration, is not to be expected because of violent gastro-intestinal disturbance or other cause, or in which it is impossible to give the drug by mouth on account of delirium, coma, etc.; and (2) in cases which are gravely ill when first seen by the physician, and in whom it is deemed imperative to secure

¹ Indian Medical Gazette, June, 1921.

² Journal of Tropical Medicine and Hygiene, June 15, 1922.

³ United States Public Health Service, 1922.

immediate cinchonization. It does not seem necessary, nor desirable, to use the intravenous route of administration in the simple acute or chronic infections ordinarily encountered, whether tertian or estivo-autumnal.

A case of *quinine poisoning* is reported by Leach.¹ The patient was a child, aged three years, who took from twenty to a hundred 2-gr. quinine pills. The symptoms were vomiting, stupor, twitching of the muscles around the mouth, combined with a slow shaking of his head from side to side or up and down, occasional spasmodic contraction of the flexor muscles of the limbs, flushed face and dilated pupils.

The ingested pills were only partly dissolved. The child recovered. While no rash developed after this overdose of quinine, the child had for a year or more previously always developed a rash after a therapeutic dose of the drug.

QUINIDINE. In 1914, Wenkelach reported 2 cases of *auricular fibrillation*, in which the normal rhythm was restored temporarily by quinine. Possibly because attention was diverted from everything else during the war this observation attracted little notice at the time. In 1918 Frey, studying the effect of various cinchona derivatives on this type of cardiac arrhythmia, found that quinine had this action to the most marked degree. Within the past two or three years the action of quinidine in auricular fibrillation has attracted a great deal of attention and the literature on the subject has been extensive. As an editorial article² points out: "Rarely has a drug made a stronger or more dramatic bid for immediate acceptance as a valuable therapeutic agent than has quinidine in auricular fibrillation. Emerging from its obscurity, where it was known only to the few as an isomer of quinine, this compound has suddenly leaped into the bright light of popularity, winning instant applause because of its startling effects in certain types of cardiac irregularity. To see a heart that has been constantly irregular for one or two years because of a fibrillating auricle lose its lawless and rapid beat within a few hours under the influence of a small amount of this drug, and assume normal rhythm and rate and maintain these for months, must attract the attention of even the most skeptical clinician or the most confirmed therapeutic nihilist."

While publications subsequent to the above have somewhat tempered the enthusiasm, there can be no doubt but that quinidine is a powerful and valuable agent in certain cases. In common with other efficient remedies, the present problem is to determine the cases in which it does good and those in which it fails or actually does harm.

Quinidine is obtained from cinchona bark as a by-product in the manufacture of quinine, to which it is closely related, being the stereoisomer of quinine. Like quinine, it is a protoplasm poison. It affects protozoa more than bacteria, but less powerfully than quinine. At one time it was used to some extent as a substitute for quinine because it was then much the cheaper preparation.

It is usually administered in the form of quinidine sulphate. Com-

¹ Journal of the American Medical Association, July 1, 1922.

² Ibid., December 3, 1921.

monly, 0.2 gm. (3 grs.) of the salt is given as a preliminary dose and is repeated after two hours to determine the patient's susceptibility to the drug. If there are no symptoms following this preliminary dose therapeutic administration is begun on the following day, when from 0.2 gm. to 0.4 gm. (3 to 6 grs.) is given from three to four times daily, for one to three days. As a rule, if the establishment of the normal rhythm can be affected the change occurs after from one to three days' treatment. The maximum dose per day advised by most observers is from 1 to 2 gm. (15 to 30 grs.). If toxic symptoms occur the administration of the drug should be discontinued.

The pharmacology of quinidine is not as yet fully understood. The general impression, however, is that quinidine and other cinchona alkaloids are the only drugs known to have this specific effect. The action of the drug on the heart has been studied by Jackson, Friedlander and Lawrence.¹ They felt that there was nothing unique in the action of quinidine on auricular fibrillation and that, perhaps, a large number of drugs which exercise a general depressant action on the cardiac muscle would, in all probability, act in a very similar manner. It appeared to them to be simply a question of selecting a substance of sufficiently low general toxicity, and one which would be eliminated from the blood but slowly, in order that a prolonged, mild depression of the auricular tissue might be produced. The drug undoubtedly acts on both ventricles and auricles. In their experiments they found that the fibrillation of the ventricles in perfused hearts was checked by the temporary addition of small quantities of potassium chloride solution to the perfusion fluid, indicating that quinidine does not possess a unique action in this regard. The authors surmise that in one course it will be found that quinidine acts on the musculature of the peripheral vessels and, perhaps, even on the skeletal muscles, in a manner quite similar to that in which it acts on the heart muscle.

It will be recalled that in auricular fibrillation the auricle is no longer contracted by impulses arising at a single point, but by a never-ending wave, which passes over and over again through the same muscular channels—what Lewis has aptly described as a circus action. Lewis, Drury² and others, and Hoffman have shown that quinidine reduces the excitability of the auricular muscle, but that the most striking action upon the auricle is a lengthening of the refractory period. In other words, that fraction of time in which the wave is traveling leaves the muscle behind it for some time incapable of response. They, therefore, believe that quinidine emphasizes or prolongs this period 50 per cent, or more, delaying the recovery of the tissue so that they do not react to the following contraction wave. Furthermore, either as a result of this or other influences, it slows conduction of the auricle. Because it impairs contractile power it is probably dangerous when the ventricle is weakened by disease.

In using quinidine in cardiac condition, it must be borne in mind that it is not without some unpleasant, and even dangerous, effects.

¹ Journal of Laboratory and Clinical Medicine, March, 1922.

² British Medical Journal, 1921.

Some patients appear much more susceptible to its toxic effects than others. The untoward symptoms are nausea, vomiting, convulsions, palpitation, headache, faintness and sloughing. In most cases, after administration of the drug, the pulse increases in rapidity before the normal rhythm is established. In some cases the effect of the drug is restricted to this alteration of rhythm. In a few cases such serious results as rapid ventricular tachycardia have been initiated during the course of therapy. Toxic effects may appear after the establishment of a normal rhythm.

Eyster and Fahr,¹ in pointing out some of the dangers of quinidine treatment, state that "In most cases, perhaps in all, disturbances of rhythm occur during the transition stage between auricular fibrillation and sino-auricular rhythm. The most characteristic and frequent of these transition rhythms is rapid, regular heart action (auricular tachycardia, "auricular flutter"), occurring either alone or in periods interspersed with periods of fibrillation. These intermediary stages may occur even when the normal rhythm is not subsequently restored, as in the first case presented here. It is apparently the result of these stages of transition, in which the dangers of the treatment lie. While acutely developing auricular fibrillation undoubtedly causes considerable mechanical deficiency of the heart, and is probably not infrequently the immediate cause of cardiac decompensation, the heart may compensate for this as it does for valve injury, particularly when it is assisted by the protective influence on ventricular stimulation of digitalization. That the removal of this compensated auricular fibrillation under the action of quinidine in producing transition rhythm may destroy clinical cardiac compensation, is illustrated by one of the cases they report. Possibly also the contractility of the ventricular muscle is reduced by the drug. The case again becomes critically ill, and if restoration of the normal sino-auricular rhythm fails, as it apparently so frequently does in the older and more severe forms of chronic heart disease, the best that can be hoped for is a tedious restoration of compensation with another period of cardiac failure with its attendant permanent damage to be charged to the quinidin treatment. On the other hand, when auricular fibrillation is unassociated with valvular or severe myocardial damage and with no history of severe circulatory failure, the cardiac reserve is able to carry the circulation through the periods of "transition rhythm" with only transitory circulatory deficiency."

Ritchie² has met with unpleasant results. It may increase the ventricular rate, it may set up multiple ventricular extrasystoles, and there is also, in his opinion, some danger of embolism from a dislodged clot in the auricles. This latter danger is also emphasized by Sir James MacKenzie, who points out that in auricular fibrillation the failure of the auricle to contract properly not rarely results in the formation of clots, and that these clots may remain *in situ* while the auricle is fibrillating only to be dislodged and sent into the general

¹ Archives of Internal Medicine, January, 1922.

² British Medical Journal, May 20, 1922.

circulation, producing infarcts, if the auricle regains its normal contractility.

All recent communications are opposed to the opinion expressed by Cheinisse,¹ that quinidine may be regarded as free from serious danger, or that of Pardee,² who, while admitting that we do not as yet know how to handle it properly, states that it is not necessary to have the patient in bed when the drug is given if the doses are not too large. He states that he has seen no harm result from giving it to 18 ambulant patients. On the other hand, Wolferth³ points out that this form of therapy is still in the experimental stage and emphasizes that close observations should be maintained, the patient being in a hospital or under the care of a well-trained nurse. The same opinion is expressed by Eyster and Fahr⁴ and by Lewis,⁵ the latter stating that it is a treatment emphatically for the wards rather than for use in an outpatient department.

Lewis believes the usefulness of the drug from the clinical standpoint is limited. The chief limitation consists in the early and very frequent resumption of auricular fibrillation. In not a few patients the restored normal rhythm lasts but a few days or a week, and fibrillation returns again and again after successive periods of treatment.

In others the normal rhythm is maintained for a few weeks or months; a few cases have been maintained for six months or a year. In the last group it must be judged an unqualified success, but in proportion, as from case to case, the return of fibrillation is less delayed, so the remedy becomes less practicable as a remedy. He deprecates the general use of the drug, and urges that it should be employed only under strictly controlled conditions.

Lewis believes that the value of quinidine has so far been greater in adding to our knowledge of fibrillation of the auricles than it has been in therapeutics. It has taught as many important facts, and among the most notable is that the hearts which display chronic auricular fibrillation are capable of beating normally—a quality hitherto in doubt. It has also taught us that the cause which predisposes to fibrillation, or at first initiates fibrillation, is maintained in the chronic state.

Sir James MacKenzie⁶ is not yet fully convinced that quinidine will do all that is claimed for it, pointing out that many remedies have on their introduction aroused great expectations which have not been fulfilled, and that some that are potent for good have also suffered from indiscriminate use and so have become unjustly discredited.

As already stated, one of the chief problems in regard to the use of quinidine is the type of case in which it should be used. Hamburger and Priest⁷ suggest the following types in the order of their decreasing

¹ Presse médicale, September 17, 1921.

² Medical Record, December 17, 1921.

³ American Journal of the Medical Sciences, 1921, **162**, 812.

⁴ Loc. cit.

⁵ American Journal of the Medical Sciences, June, 1922.

⁶ British Medical Journal, 1921.

⁷ Journal of the American Medical Association, July 15, 1922.

suitability for quinidine treatment: (a) Patients with acute fibrillation or recurrent paroxysmal fibrillation; (b) patients with fibrillation of short duration without history or findings of heart failure or embolism; (c) patients with signs and symptoms of early or apparent heart failure, but without evidence of advanced heart failure.

Fred M. Smith¹ found the treatment most successful in those in whom auricular fibrillation was of short duration and associated with a good cardiac musculature. In this group, however, the results could not always be produced.

Wolferth² points out that the most favorable cases for treatment are those with: (1) Relatively good heart muscle and at least fair compensation; and (2) flutter or fibrillation that has been present only a short time.

Ritchie³ considers that quinidine should not be used in cases in which there are such signs of cardiac failure as dilatation of the heart, drowsy or cyanosis.

Hewlett and Sweeney⁴ are of the opinion that, in view of the possible dangers associated with the administration to cardiac patients, quinidine should be given only after decompensation has been treated by other methods, and when the patient is kept under careful observation.

Opinion as to the use of digitalis and quinidine in combination is not in agreement. Starkenstein⁵ states that the use of quinine and digitalis combined is justified if, in connection with prolonged digitalis medication, it is necessary to counteract possible cumulative effects or other dangers from intoxication. On the other hand, Hewlett and Sweeney⁶ assert that combinations of quinidine and digitalis should probably be avoided. In collections of reported cases of auricular fibrillation, the number responding favorably to quinidine is about 50 per cent of the total.

Radium and Roentgen-ray. The use of radium is becoming more and more prevalent. There can be no doubt that there are many, many individuals suffering from *malignant disease* past the operable stage, who have been given great relief from the use of radium. Deaver,⁷ in an article on radium therapy, with special reference to disease of the female pelvis, closes with the statement that whatever may be the future of radium therapy, the fact remains that it is today not the panacea for cancer, the advent of which is so eagerly being awaited, for in numerous cases in which it is most needed it has not as yet fulfilled expectations. It would seem that he clouds the issue. No one claims that radium therapy is perfected, or that it is in anything but the experimental stage. No one claims that it is a panacea for cancer. What is claimed is that it has a remarkable effect on malignant growths, so much so, that there is much more to be hoped for when its effects and the method of using it are better understood.

¹ Journal of the American Medical Association, March 25, 1922.

² Loc. cit.

⁴ Journal of the American Medical Association, December 3, 1921.

⁵ Deutsche med. Wchnschr., March, 31, 1922.

⁶ Loc. cit.

⁷ Therapeutic Gazette, July, 1922.

³ Loc. cit.

Knox,¹ in refuting the statement of a well-known surgeon that radium has proved a failure, and that surgeons were giving up its use and turning to penetrating roentgen rays in the treatment of malignant disease, states that this is not true. The real reason for any such statement lies in the fact that disappointing results have followed radium in those cases which were quite unsuitable and hopeless. On the other hand, there are innumerable cases which were hopelessly inoperable which have been given the greatest relief.

In the treatment of *basal-cell carcinoma of the face*, Morrow and Toussig² state that it is seldom necessary to use buried bare tubes of radium. Except in the deeply infiltrated and very extensive cases, surface application is usually satisfactory. In the great majority of squamous-cell carcinomas the buried tubes, in association with surface applications, have been helpful. In the case of deep carcinomatous infiltrations the buried tubes are almost a necessity.

The question of when to operate and when to use radium in dealing with *fibroids of the uterus* is considered by Gellhorn.³ He gives the advantage of radiotherapy as follows:

1. *Clinical Cures.* These are obtained in what probably constitutes more than 60 per cent of all cases of fibroids coming under our care.

2. *The Element of Safety.* In the hands of the expert this method has no mortality, whereas after operations there is, even in the hands of excellent surgeons, an average mortality of from 3 to 5 per cent.

3. *Morbidity.* There is an insignificant morbidity after radiotherapy which is steadily growing less as the result of improved technic. At any rate, the patients are spared the mental and physical suffering that any major operation entails.

4. *The Economic Aspect.* Radium treatment is not inexpensive; but as the patients hardly ever remain in the hospital more than two or three days, the expenses for hospital, nurses and dressings are saved, so that the total expense connected with radium treatment is considerably below that of operative treatment. Then, too, the patients are not kept away from their occupation for any length of time, and, finally, the overcrowded condition of our hospitals is relieved.

He believes the cases in which surgery is applicable are fairly well defined. Thus, all tumors extending above the umbilicus, and, likewise, all large pedunculated, subserous or submucous fibroids should be operated upon, for in these three classes radiotherapy is likely to produce a necrosis of the tumors. Cervical fibroids are equally unsuited for radium, and should be removed surgically. This is also true of suppurating necrotic or gangrenous tumors, and those which are undergoing cystic or calcareous degeneration.

The age incidence, in Gellhorn's opinion, is a decisive indication for operation. This means that, as a rule, women under forty years should be operated upon rather than exposed to radium. The younger the patient, the more clearly is operation advisable, as the preservation

¹ British Medical Journal, April 22, 1922.

² Archives of Dermatology and Syphilology, January, 1922.

³ Journal of the American Medical Association, January, 1922.

of the menstrual function and the restoring of fertility are to be borne in mind.

Gellhorn also considers a third group in which either of the two methods may be used. Rapidly growing fibroids, which may be suspected of malignant changes, may be operated upon or treated with radium. The latter is safe and is known to rapidly kill the cancer cells. There is another group in which the fibroid is incarcerated in the pelvic cavity, and may encroach on some one of the surrounding viscera. They may be removed surgically, but, on the other hand, they have been known to shrink rapidly under the use of radium.

Faure¹ regards medium-sized hemorrhagic fibromas as the special field of radium and also cases in which, from weakness or other cause, operation is inadvisable. In all other cases he prefers operation, particularly in young women when the fibroid is small, and can be removed without interfering with the ovarian function.

Koenig² considers uterine hemorrhage aside from those caused by cancer and fibroids. In this group, he states, the regularity of cures under radium is striking. For women over forty years it is the method of choice, but for younger women it should be reserved for use after the ordinary measures have failed.

Castano,³ of Argentina, reports his experience with the use of radium in 250 cases of fibromas. His results were most encouraging.

Ross⁴ reports the case of a woman who developed typical asthmatic attacks following the use of radium to control severe uterine bleeding. For a time the attacks were believed to be due to the artificial menopause. All methods of treatment failing, Ross tried ovarian and mammary extracts. The women showed improvement at once and finally made a complete recovery.

It is well known that the roentgen rays have a marked action on *goiters*. In the case of small goiters several applications will cause their entire disappearance. Terry⁵ has made a second report on the use of radium in the treatment of goiters. He states that the tubes can be introduced easily into the thyroid gland under local anesthesia. The amount of emanations and the number of tubes should vary according to the size of the goiter and the intensity of the symptoms—from 4 to 10 millicuries, contained in from six to eight tubes. The emanations are of value in preparing bad risk cases of exophthalmic goiter for further surgical treatment, but should not be used in adenomatous goiters.

In the treatment of *toxic* goiter, Lafferty⁶ states that medical treatment (including all hygienic measures) accomplished results if used very early, but the effects are greatly augmented by the use of radium. Surgery will give the results, but should, as in other conditions, be

¹ Gynécologie et Obstétrique, October, 1921.

² Ibid.

³ Semana Medica, January 12, 1922; Abstract, Journal of the American Medical Association.

⁴ British Medical Journal, January 7, 1922.

⁵ Journal of the American Medical Association, July 1, 1922.

⁶ Southern Medicine and Surgery, August, 1921.

reserved as a last resort. Furthermore, radiation as a preoperative measure in extreme cases is invaluable.

As a rule, the first symptoms to disappear are the nervousness and sleeplessness, and this is followed by the improvement in the circulatory system, though occasionally the order is reversed. Then gradually the other symptoms disappear, except the tumor and the exophthalmos; which leave slowly, if at all.

Lafferty believes that radiation should be used, since it does give relief and generally a cure, and since, if used properly, no harmful results are obtained; it does not in any way preclude surgery later if it is found that the case does not respond to radiation.

This would seem to be a distinct advantage over the roentgen rays, which tend to produce adhesions and hence are objected to by surgeons because it makes operative interference, if needed, more difficult.

Fischer¹ reviews his results with *radiotherapy* in 490 cases of *exophthalmic goiter*. He states that the weight increases, sweating and diarrhea and glycosuria, noted in 3 per cent, disappeared. Tachycardia was the most constant symptom, and this disappeared entirely in 25 per cent, and was materially modified in another 50 per cent. In the others the pulse-rate ranged from 100 to 120, but the patients felt well. Exophthalmos was the hardest to control; the effect was most marked in those cases in which the exophthalmos was recent. Soft goiters yield the soonest while the hard ones first soften and then slowly subside.

Care should be exercised in the severe cases as death may follow the radiation.

Fischer states that, in his experience, radiation does not make subsequent operative interference more difficult.

During the past year or so the most favorable reports have been made in the use of the roentgen rays in the treatment of *diseased tonsils*. Many of the reports indicate that this method of treatment is superior to enucleation. It must be borne in mind that removal of the tonsils is not, as many would have us believe, a trivial operation. In adults, especially, it is to be regarded as a major operation, and one that may be attended with serious dangers. Furthermore, we have come to learn that the occurrence of pulmonary abscess following tonsillectomy is becoming alarmingly frequent, especially in adults. If, therefore, these dangers can be avoided, and equally satisfactory results obtained by exposure of the diseased tonsil to the roentgen rays, a great advance has been made.

Lafferty and Phillips² favor this method as against surgical treatment. They state that it is safer, more effective and overcomes the objection of the patient to the knife. Furthermore, the adenoid tissue of the whole throat, the tonsils, postnasal adenoids and scattered adenoid tissue in the pharynx is reached by this treatment.

Quick³ has treated 149 cases of *malignant neoplasms of the tonsil*

¹ Ugeskrift for Laeger, April 13, 1922; Abstract, Journal of the American Medical Association.

² Southern Medical Journal, March, 1922.

³ Journal of Radiology, May, 1922.

with radium. His results are most encouraging. Thus, of 28 cases of carcinoma of the tonsil reported clinically free from disease at present, the average duration since the initial treatment is twenty-six months, the longest being fifty-six months.

In 2 cases of sarcoma of the tonsil which I have seen, the greatest relief from pain and the danger of starvation from obstruction was given by exposure to radium. Even if these cases cannot be cured the evidence so far at hand is greatly in favor of the method as a palliative in inoperable cases.

Salicylates. The action of the salicylates in *acute rheumatic fever* has been under discussion for several years. It is admitted that they do afford relief to many patients while the medication is continued. Whether they have a curative or bactericidal action has not been clear. The most recent study has been contributed by Boots and Cullen.¹ Using all the precautions necessary for the study of hydrogen-ion concentration, they found the joint fluids to be slightly alkaline. As a definitely acid medium is necessary for the action of salicylic acid, the latter cannot exist free in the joint fluids after the administration of salicylates. Therefore, any advantage from their use in rheumatic fever cannot be ascribed to bactericidal effects.

The untoward effects of the salicylates are generally traceable in Caussade and Charpy's² opinion to impurities in the original salicylic acid. They state there are only 10 cases on record of fatal intoxication from their use.

Serum. A case of *optic neuritis* occurring in *serum sickness* is reported by Mason.³ The patient was admitted to the hospital on the second day after the onset of acute lobar pneumonia, Type I. During the third, fourth, fifth and sixth days of the disease the patient received 500 cc of Type I antipneumococcus serum intravenously. Crisis on the seventh day. Severe serum sickness appeared on the ninth day, and was present for fourteen days. During the course of the serum disease a well-marked, bilateral optic neuritis was observed. The optic neuritis was not associated with demonstrable visual disturbances. At the end of three months the fundi had returned to normal in appearance.

Search of the literature failed to reveal a similar case. He subsequently observed, however, 2 additional cases, showing mild grades of optic neuritis without visual disturbances. One was a child given antimeningitis serum and the other was an adult receiving Type I antipneumococcus serum.

Carrieu⁴ observed a case of *bilateral orchitis* in a boy, aged thirteen years, who had received diphtheria antitoxin. The orchitis was preceded a day by fever, an itching eruption and pain in the joints when moved. The testicles remained painful and swollen for six days, although the other evidences of serum sickness quickly subsided.

¹ Proceedings of the Society of Experimental Biology and Medicine, March 15, 1922.

² Revue de Médecine, March, 1921.

³ Journal of the American Medical Association, January 14, 1922.

⁴ Archives de médecine des enfants, April, 1922.

ANTIANTHRAX SERUM. Regan¹ believes that, inasmuch as anthrax in man is primarily a local infection, with a decided tendency to remain as such, any treatment which tends through the barrier set up by Nature is faulty. He advocates the use of serum both locally and generally. The local injection of serum around the lesion every twelve to twenty-four hours is a most desirable method to replace the local measures until lately in common use.

Symmers, who has had a large experience with anthrax, has, for some time, favored the use of serum locally and generally instead of combined excision and serum.

Antianthrax serum is now marketed by Parke, Davis & Co., in syringes containing 50 cc. The initial dose is from 50 to 100 cc, injected intravenously, to be followed by further injections in six or more hours. It is well to test the sensitization of the patient to horse serum, prior to the first injection, by means of the cutaneous test, which will require about half an hour. The drop of serum required for this test can be obtained directly from the syringe container of antianthrax serum.

ANTIDIPHThERIC SERUM. More and more the practice of giving large doses of diphtheria antitoxin is becoming the accepted practice. Bie² gives from 4000 to 40,000 units in the milder cases, and does not repeat the dose unless the membranes spread. In the severe cases he employs doses up to 80,000 or 100,000 units to a total of 160,000 units in the first twenty-four or thirty-six hours in children under ten years of age, or 220,000 units in elder children. About 20 cc of the first dose is given intravenously; all the other injections are given intramuscularly.

Bie states that since these large doses have been employed there have been no deaths from respiratory paralysis, and the mortality in the very gravest cases has been reduced from an average of 52 to 22 per cent. Furthermore, while the proportion of very severe cases has doubled since 1896, the total mortality has declined from 2.6 per cent in 869 cases in 1917 to 0.7 per cent in 1341 cases since these large doses have been the rule. The less severe cases ran a harmless course.

Thomson³ states that, while attempts have been made to determine the dose according to weight, the fact remains that the child requires as large a dose as the adult. To arrive at the approximate dose, one has to be guided by the stage of the disease, the rapidity of progress from the onset of the symptoms, the amount of membrane, the amount of inflammation and edema, the amount of glandular swelling, and the amount of cellular infiltration. Also, whether the nasopharynx is involved, as indicated by nasal discharge, and whether it is blood stained; whether there is hemorrhage into the skin, and whether there are subcutaneous hemorrhages and, finally, whether the larynx is affected and there is fetor. One should not be influenced by the amount

¹ American Journal of the Medical Sciences, September, 1921; Abstract, Journal of the American Medical Association, December 17, 1921.

² Ugeskrift for Laeger, July 28, 1921; Abstract, Journal of the American Medical Association.

³ Lancet, July 9, 1921.

of membrane alone, as most serious cases often occur without any membrane.

Thomson states that, having come to a probable estimate of the dose, it is wise, in severe cases, to add about 4000 additional units to cover possible error. He quotes Rolleston as recommending the following doses: For severe faucial cases, 16,000 to 20,000 units, and a similar or sometimes smaller dose on one or two of the following days. For moderately severe faucial cases, 8000 to 12,000 units, occasionally repeated on the following day. For mild faucial cases, 4000 to 8000 units, repetition rarely being necessary. For nasal, laryngeal, conjunctival or aural diphtheria, in which there is no faucial involvement, 4000 to 12,000 units.

Thompson points out that ideally the amount of antitoxin necessary should be given in one dose, but it is very difficult to estimate the quantity, and so second doses are often required. It is desirable that the second dose should be given not later than twenty-four hours after the first, and repeated doses extending over a few days are not to be recommended.

ANTIDYSENTERIC SERUM. The serum treatment of bacillary dysentery in children is unfavorably reported by Josephs and Davison.¹ In a series of 20 cases they were unable to see that the serum had any influence either on the mortality or the course of the disease. Furthermore, in the very ill, especially in young infants, the pain at the site of injection is a contraindication to the use of intramuscular injections.

ANTIPNEUMOCOCCUS SERUM. Thomas² reports on 60 cases of pneumonia, Type I, 50 receiving serum and 10 did not. In addition, he reviews 550 cases reported in the literature exclusive of the Rockefeller Institute series.

The material on which he bases his report indicates that Type I pneumonia, however treated, varies in its mortality rate with the time and place of its occurrence, and suggests that it may perhaps be not so frequently fatal as is generally believed to be the case.

In his series of 50 serum-treated cases the serum (Type I) appeared to shorten the disease in 4. In 8 the use of serum, though followed by improvement in the symptoms, appeared to have only a transitory effect. Among the remaining 38 patients, the duration and outcome of the disease did not appear to have been demonstrably affected by the serum.

Of the 50 cases receiving the serum the duration of fever was nine and a half days; among those not so treated (10 cases) it was eight and two-tenths days.

Ten patients of his series suffered from anaphylaxis and were relieved by epinephrin. Of these 10 patients, 6 had previously shown no reaction to dermal tests for sensitiveness to horse serum.

He believes that skin tests with the protein of horse epidermis, as well as with that of horse serum, should precede the intravenous injection of the specific serum.

¹ Journal of the American Medical Association, December 10, 1921.

² Ibid., December 31, 1921.

Serum sickness followed the use of Type I serum in 36 of 50 cases. In 15 the symptoms were severe. Epinephrin allays the discomfort of the eruption temporarily.

ANTISTREPTOCOCCUS SERUM. Of all the sera that have been employed, the various forms (special types, polyvalent) of antistreptococcus serum has been the least satisfactory. Dick¹ reports a case of malignant endocarditis, in which various attempts were made to influence the condition by means of antistreptococcus serum. He was forced to conclude that the intravenous injection of fresh serum from a sheep immunized with the patient's strain of *Streptococcus viridans* produced no benefit. Neither did human serum from a person immunized with the patient's streptococcus, given intravenously, aid. And, finally, fresh, whole blood from a person similarly immunized was of no value when given subcutaneously; but this whole blood did produce a definite temporary improvement.

ANTITETANIC SERUM. Although the use of this serum is of doubtful curative value, its use as a preventive is firmly established. Stone² emphasizes the fact that the most important factor in the treatment of *tetanus* is its prevention. It should be the universal rule to give a prophylactic dose of 1500 units of antitoxin to all patients who have received lacerated or penetrating wounds. If the wound contains necrotic tissue or a suspected foreign body the dose should be repeated in ten days and subsequently if operation on the wound is contemplated.

As a matter of fact, I believe that this is now a generally recognized procedure. The crusade inaugurated years ago by the American Medical Association against Fourth of July injuries has resulted in an extraordinary reduction of the incidence of tetanus. The lesson of treating penetrating wounds, such as those produced by stepping on a nail, has been thoroughly taken to heart.

Although the curative effect of the serum is of doubtful utility, it should be used and in large quantities. Stone advises that if symptoms have appeared the attempt should be made to saturate the patient with the antitoxin before fixation of the toxin has occurred in the nerve cells of the spinal cord. This can best be accomplished by intraspinal and intravenous injections during the first three days of treatment; the total dosage, of which half should be given intraspinally, should approximate 125,000 units.

MEASLES. The prophylactic use of serum obtained from immunized patients has been reported by McNeal.³ Sixteen children, who had been exposed to measles, received intramuscular injections of 5 cc of serum obtained from healthy donors between the fifth and ninth days after the disappearance of fever. Twelve of the children escaped the infection, and 4 developed it in a mild form. As 1 child contracted measles two months later, it suggests that the immunity does not persist longer than sixty days.

McNeal believes that the method may prove of great value in pro-

¹ Journal of the American Medical Association, April 22, 1922.

² Ibid., June 24, 1922.

³ Ibid., February 4, 1922.

tecting children during the period of danger, between the ages of five months and six years, in tuberculous children and in those physically below normal. Also in institutions it should prove of great value.

Silver. The use of silver nitrate in the treatment of *asthma* is reported by Syme.¹ He applies a 10 per cent solution of silver nitrate to the mucous membrane of the bronchioles through a bronchoscope. He has treated 23 patients, ranging in age from ten to sixty years. Eighteen received the application on one occasion only, 4 on two and 1 on four occasions. In 12 the benefit was so decided that no spasmodic attacks of a severity sufficient to discommode the patient to any serious degree occurred. In 2 there was no benefit, and in the remainder varying degrees of relief were afforded.

In former years, when silver nitrate was a favorite remedy in the treatment of gastric ulcer, cases of *argyria* were not uncommon, owing to the prolonged use of this drug in some cases. Kimball² reports the case of a man, with duodenal ulcer, who had taken 10 minims of a 10 per cent solution of silver nitrate after meals for eighteen months. Marked argyria resulted, associated with severe secondary anemia and the presence of much albumen and fine granular casts in the urine.

In answer to a query as to whether *silver arsphenamine* ever caused argyria, the *Journal of the American Medical Association* replied that 2 cases had been reported. A few days after the injection the patients noticed an ashen-gray discoloration of the skin, which rapidly became more marked, finally assuming a steel-gray color. The sclera of the eyes was also affected. Both cases were reported in the *Therapeutische Halbmonatshefte*, June 15 and November 1, 1920.

Sodium Bicarbonate. The occurrence of *tetany* following the use of sodium bicarbonate is reported by Healy.³ Of the 7 cases reported, all were patients in whom a celiotomy had been performed for pelvic trouble. There were 4 deaths and 3 recoveries. The onset of the typical hand symptoms were observed as early as seven hours after operation and the symptoms terminated within forty-eight hours, either in response to treatment or by death of the patient.

The symptoms in the fatal cases were tachycardia, profuse diaphoresis, hyperpyrexia, epigastric distress, bilateral, symmetrical spasms and contractions of muscles, especially of the upper extremities and convulsions.

The source of the trouble was traced to the glucose and sodium bicarbonate enema administered as a routine in most of the major operative cases. This was supposed to contain 5 per cent glucose and 5 per cent sodium bicarbonate in 8 ounces of water. This enema was given as soon as possible after the return of the patient from the operating-room and again in four hours. The first enema also contained 40 grs. of sodium bromide. Through an error of calculation 1200 grs. of sodium bicarbonate was given instead of 180.

The last 3 patients recovered after the administration of *sodium*

¹ Journal of Laryngology and Otology, September, 1921.

² Ohio State Medical Journal, May, 1922.

³ American Journal of Obstetrics and Gynecology, August, 1921.

lactate by mouth. The cases occurred irregularly over a period of four months.

Sodium Lactate. The use of this drug in the treatment of *acetonemia* is advocated by Madigliani,¹ who claims that it does not cause intolerance even given to infants up to 30 gms. per day. He has used it in 13 cases, giving from 12 to 30 gms. at first and then less in the following three or four days. The urine becomes alkaline by the second day in all, and the tests for acetone were negative by the third or fourth day. Headache, vomiting, fever, dyspnea and the odor on the breath promptly subsided.

The sodium lactate can be generated at the time by mixing in 30 cc of hot water two tablespoonfuls of 10 per cent solution of lactic acid in distilled water, and two tablespoonfuls of a 7.5 per cent solution of sodium bicarbonate.

Sodium Morrhuate. The use of this cod-liver oil derivative has been used in the treatment of *tuberculosis*. Davies² is convinced that many of his patients have derived considerable benefit from its use.

Sulphonal. In an article on the uses and doses of hypnotics, Wyatt-Smith³ states that sulphonal, except for its high price, is the best, and that, in addition, it is a decided mental sedative. It appears to be quite safe in doses up to at least 1 dr. a day, given in individual doses of 30 grs. night and morning, or, better, of 20 grs. three times daily.

Tikitiki Extract. This is the active principle of rice polishings. There are two grades of rice polishings or tikitiki, one from the light-colored or white rice, and the other from red rice. The latter did not give satisfactory results experimentally. Wells⁴ states that tikitiki extract has shown that it possesses a high percentage of neuritis-preventing substances and that it is a cure for infantile *beriberi*.

Tuberculin. During the past year the editor of the *Therapeutic Gazette* (March and April, 1922) sent out a questionnaire on the treatment of *tuberculosis*. In regard to the use of tuberculin, the best that can be said of the answers submitted is that this agent is of value in the pulmonary form of the disease. Most of the answers were unfavorable, or hedged about with qualifications as to the time and type of case it should be employed in. One or two observers still retained their enthusiasm. There can be no doubt that the past ten years has seen a great change of faith in the use of this agent.

Fischel⁵ admits that tuberculin has not wholly satisfied the hopes originally cherished for it. He ascribes this to a failure to recognize the disease sufficiently early to obtain the results that tuberculin is capable of giving.

Turpentine. For the control of severe *hemorrhage* following the extraction of teeth, Steadman⁶ recommends turpentine. The method

¹ Rivista di Clinica Pediatrica, March, 1922; Abstract, Journal of the American Medical Association.

² Indian Medical Gazette, August, 1921.

³ Practitioner, September, 1921.

⁴ Philippine Journal of Science, July, 1921.

⁵ Tubercle, September, 1921.

⁶ British Dental Journal, April 1, 1922.

of application is simple. The gauze is soaked in the oil of turpentine and the socket packed; if necessary, it is kept in place by stitching or by applying a pad over the gum and bandaging the jaws. Steadman adds that oil of turpentine is a powerful antiseptic, and that after the plug is removed the sockets retain a faint smell of turpentine and are clean and free from infection. This is in striking contrast to the usual experience after plugging, when the socket is generally septic and takes a long time to heal.

Vaccines. **PERTUSSIS.** Reports on the efficacy of pertussis vaccine are conflicting; some are very enthusiastic—others, adverse. Davies,¹ in an experience with 33 children suffering from whooping-cough, states that, although it appears that the individual child responds differently to the vaccine, the duration of the disease is shortened by the administration. The duration in light, uncomplicated cases is given as from eight to twelve weeks; the more severe cases last a longer period. Paroxysms were lessened in severity and duration, and whooping and vomiting were alleviated. The most severe reactions occurred in children with valvular heart lesions.

Auricchio,² in tabulating the results obtained in 196 cases, states that only 14 did not show benefit from the treatment, while 67.8 per cent were cured, and 26 per cent were improved. In the 6.2 per cent, in which no benefit was obtained, the disease was either far advanced or other pathologic conditions interfered with the vaccine therapy.

Paterson and Smellie³ found no special benefit from the use of vaccines. They believe that the most valuable aids in shortening the disease and relieving the severity of the symptoms, are allowing the child to run about in the open, frequent feeding of small amounts of food and the use of cod-liver oil.

TYPHOID. When the practice of employing typhoid vaccination came into use the charge was made from time to time that it was frequently followed by active tuberculosis. This has been thoroughly disproved. Now the extraordinary charge is made by an anti-vaccinationist, one Walter R. Hadwen, of England, that typhoid vaccination had resulted in the causation of enormous numbers of heart disease among British soldiers. He has asserted in two public addresses that the British Government was paying \$20,000,000 per year in pension to soldiers invalided and discharged from the British Army for heart disease, and that nine-tenths of these cases were due to typhoid vaccination.

As pointed out in an editorial article,⁴ the Director-General of the British Army Medical Service entirely disproved these assertions insofar as heart lesions are concerned. As the result of a special study, long before the charges of Hadwen were made, the heart cases were all satisfactorily accounted for. It is furthermore of interest to note the results of typhoid vaccination in reducing the incidence of typhoid

¹ American Journal of the Diseases of Children, May, 1922.

² *Pediatrics*, November 15, 1921.

³ British Medical Journal, May 6, 1922.

⁴ Journal of the American Medical Association, February 11, 1922.

fever. In the Boer War, from 1899 to 1902, with a mean annual strength of 208,226 men, there were 57,864 cases of typhoid fever and 8022 deaths, and annual death-rate of 14.6 per cent. In the World War, with a mean annual strength of 2,000,000, or almost exactly ten times as many men as in the Boer War, there were only 20,139 cases of typhoid fever and 1191 deaths, an annual death-rate of 0.139 per cent, or less than one one-hundredth of the death-rate of the Boer War. In our own army, General Ireland states, out of a total of 4,128,478 men, from April 1, 1917, to December 31, 1919, there were 1529 cases of typhoid fever and 227 deaths, or 0.0054 per cent.

Venesection. We have pointed out in former issues of PROGRESSIVE MEDICINE the fact that relatively few of the present generation realize the value of venesection. Once the panacea for all ailments, it became so thoroughly discredited that it is seldom resorted to today. Peterson and Levinson¹ advocate the employment of venesection in *lobar pneumonia*. They state their reasons as follows: Briefly, it may be stated that in the exudate of the consolidated lung a balance exists between the amount of enzyme present and the antiferment of the plasma and tissue exudate. Early in the disease the leukocytes at the focus are living and have not shed their enzyme content. As they die, the enzymes diffuse into the surrounding mediums. If at any time the enzyme concentration overbalances the inhibition of the tissue fluids, active proteolysis will commence and the crisis ensue. If in place of this increase in the enzyme concentration we can diminish the amount of the antiferment, the same augmentation of proteolysis will be brought about. This may take place, increasing the acidity of the exudate, or actually diminishing the amount of plasma present in the exudate.

It is at once apparent, they believe, that venesection may have a direct influence on this balance. The depletion of the fluids in the vascular beds results in a prompt compensation by means of fluids drawn from the tissue spaces. This will somewhat diminish the amount of antienzyme. Again, it is to be remembered that the serum after bleeding has less antiferment than normally, *i. e.*, the fluids reaching the focus would have less inhibiting substance than before. So, too, diminution in alkali reserve would tend to increase the acidity of the exudate.

In the opinion of Peterson and Levinson, we have, therefore, at least three alterations following phlebotomy that seem of importance in directly influencing the ferment, antiferment balance of the exudate in the direction of acceleration of proteolysis.

Zinc. The use of talcum as a dusting powder in the toilet of infants has been replaced, to a great extent, by *stearate of zinc*. Curiously enough, this last-mentioned substance is not without danger. Herman and Aschner² have called attention to the fact that disastrous results have occurred as the result of the aspiration of this powder. They have studied 12 cases and, in addition, have noted the effects of stearate of zinc insufflation in animals.

¹ Journal of the American Medical Association, January 28, 1922.

² American Journal of Diseases of Children, June, 1922.

The onset of trouble is sudden and stormy, with rapid respirations and cyanosis. Complete asphyxia may occur. In 8 cases the initial partial asphyxia was followed by a gradual recovery without definite involvement of the lungs. The rapid respirations and cyanosis, which followed immediately on the inhalation of the powder, subsided during the course of three days.

It is known that insufflation pneumonia may be produced by non-infective particles. Evidently, the pneumonic lesions due to zinc stearate are analogous in origin. Talcum is less dangerous and more easily expelled if inhaled.

Herman and Aschner believe that the zinc stearate container, with its large perforations, as now used in the nursery, is a distinct menace to the health of infants and should be banished.

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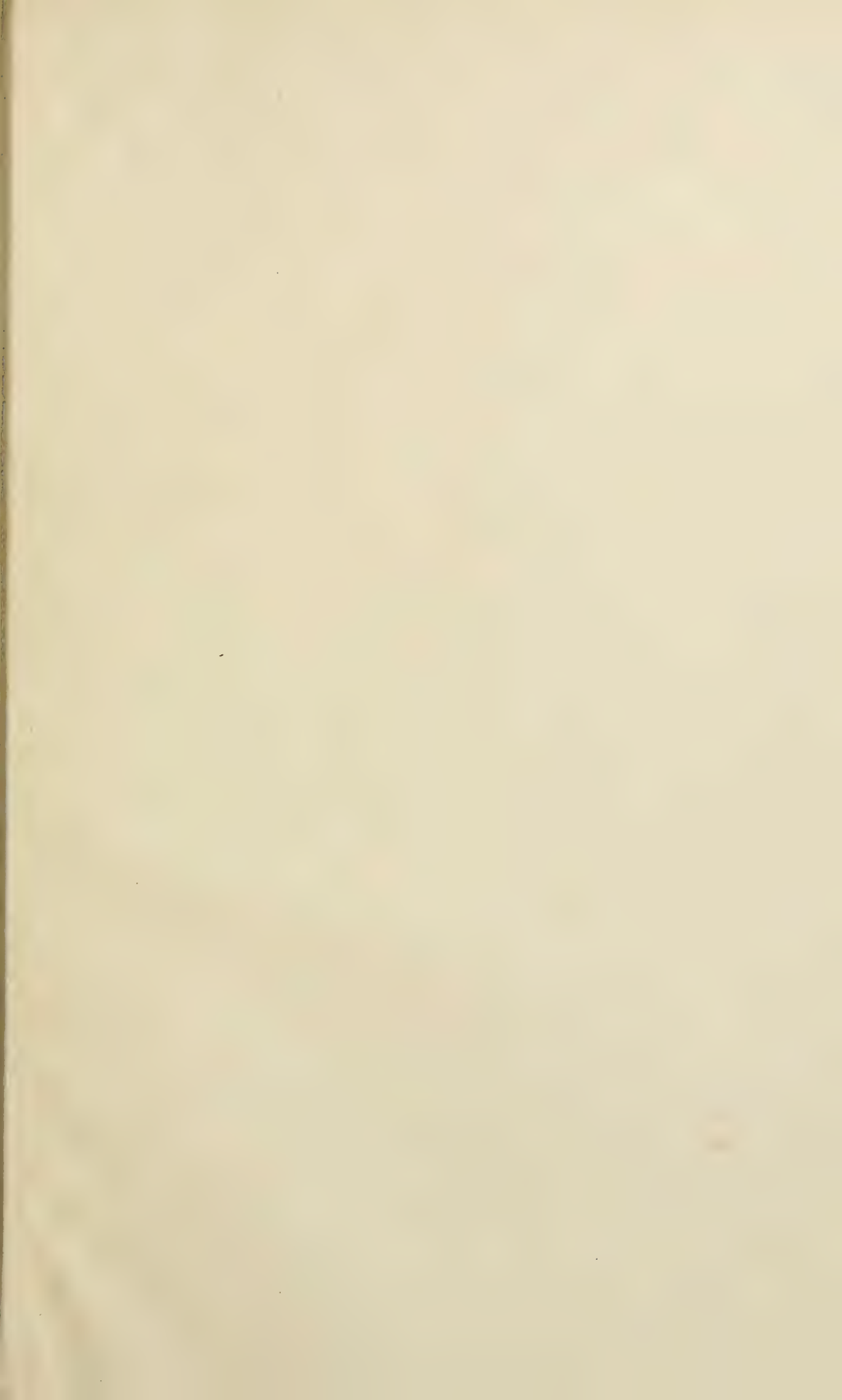
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